OPERATION AND SERVICE MANUAL

© Copyright
SYSTRON DONNER CORPORATION
ONE SYSTRON DRIVE
CONCORD, CALIFORNIA 94518 USA

MODEL 4809A

MICROWAVE TUNING UNIT

MICROWAVE DIVISION
SYSTRON DONNER CORPORATION
INSTRUMENT GROUP

PRINTED 8/76
MANUAL P/N 109824

SYSTRON DONNER

EQUIPMENT WARRANTY

Seller warrants equipment of its manufacture against defective materials or workmanship for a period of one year from date of shipment.

The liability of Seller under this warranty is limited, at Seller's option, solely to repair, replacement with equivalent Systron-Donner equipment, or an appropriate credit adjustment not to exceed the original equipment sales price, of equipment returned to the Seller provided that:

> The defective equipment is returned to Seller's designated repair location, transportation charges prepaid by Buyer, and,
>
> Seller's examination of such equipment discloses to its satisfaction that defects were not caused by negligence, misuse, improper installation, accident, or unauthorized repair or alteration by the Buyer.

In no event shall Seller be liable for collateral or consequential damages due to defective equipment.

This warranty does not include mechanical parts failing from normal usage nor does it cover limited-life electrical components which deteriorate with age such as vacuum tubes, batteries, lamps, or accessories not manufactured by the Seller, but which are furnished with the Seller's equipment. Seller's liability is limited to whatever warranty is extended by the manufacturers thereof and transferable to the Buyer.

This warranty is applicable to the original Buyer only and constitutes the sole and exclusive warranty of Seller.

This warranty is in lieu of any other warranty, expressed implied or statutory and no agreement extending or modifying it will be binding upon Seller unless in writing and signed by a duly authorized officer.

LIST OF EFFECTIVE PAGES

PAGE	CHANGE	PAGE	CHANGE
i thru iv	Original	5-1 thru 5-20	Original
1-1 thru 1-6	Original	6-1 thru 6-24	Original
2-1 thru 2-2	Original	7-1 thru 7-20	Original
3-1 thru 3-10	Original	8-1 thru 8-32	Original
4-1 thru 4-24	Original	9-1 thru 9-28	Original

NOTE 1) All Original pages are undated.

NOTE 2) Please report errors and omissions in this manual to:

SYSTRON-DONNER CORPORATION
Microwave Division
14844 Oxnard Street
Van Nuys, California 91411

This report should include the manual title, date of last change, and exact location (by page, paragraph, line, or figure) of the error. Also include the model number, serial number, and numbers of modifications or options (if any) pertinent to your instrument.

TABLE OF CONTENTS

Section			Page
I	GENERAL INFORMATION		1-1
	1-1.	Scope	1-1
	1-2.	Description of Equipment	1-1
	1-3.	Capabilities and Performance	1-1
II	INSTALLATION		2-1
	2-1.	Removal	2-1
	2-2.	Installation	2-1
	2-3.	Alignment	2-1
III	OPERATING INSTRUCTIONS		3-1
	3-1.	Scope	3-1
	3-2.	Front Panel Controls and Indicators	3-1
	3-3.	Condensed Operating Instructions	3-1
	3-4.	Hints and Precautions	3-1
	3-5.	Operating Modes	3-8
	3-6.	Calculating the Amplitude of a Signal of Interest	3-9
	3-7.	Use of the 100 MHz Calibrator	3-10
IV	CIRCUIT DESCRIPTION		4-1
	4-1.	Overall Function Description	4-1
	4-2.	Detailed Functional Descriptions	4-4
V	MAINTENANCE		5-1
	5-1.	General	5-1
	5-2.	Overall Checkout and Troubleshooting	5-1
	5-3.	General Procedure for Measuring Noise Level	5-9
	5-4.	Detailed Troubleshooting of Replaceable Modules	5-10
	5-5.	Repair and Replacement	5-10
VI	PERFORMANCE CHECKS		6-1
	6-1.	Introduction	6-1
	6-2.	Equipment Required	6-2
	6-3.	Functional Check	6-2
	6-4.	Residual Responses	6-4
	6-5.	Tuning Accuracy	6-5
	6-6.	Local Oscillator Stability	6-6
	6-7.	Noise Sidebands	6-8
	6-8.	Frequency Span Accuracy	6-9
	6-9.	IF Shape Factor	6-10
	6-10.	Amplitude Display Accuracy	6-11
	6-11.	Attenuator Accuracy	6-13

TABLE OF CONTENTS (Continued)

Section		Page
VI	PERFORMANCE CHECKS (Continued)	
	6-12. Sensitivity	6-14
	6-13. Intermodulation Distortion	6-15
	6-14. Frequency Response	6-16
	6-15. Waveguide Mixer Checks	6-18
	6-16. Reference Voltage Checks	6-20
	6-17. Noise Level Check	6-20
	6-18. First Local Oscillator Power and Response Check	6-21
	6-19. 2050 MHz IF Sensitivity Check	6-22
VII	CALIBRATION	7-1
	7-1. General	7-1
	7-2. Preliminary Checks	7-2
	7-3. System Alignment	7-2
	7-4. Detailed Calibration Procedures	7-5
VIII	REPLACEABLE PARTS LIST	8-1
	8-1. Introduction	8-1
	8-2. Explanation of Columns	8-1
	8-3. Manufacturer's Codes	8-1
IX	CIRCUIT DIAGRAMS	9-1

LIST OF ILLUSTRATIONS

Figure	Title	Page
1-0	Systron Donner Model 4809A Microwave Tuning Unit	1-0
3-2	Front Panel Controls and Indicators	3-2
3-6	Condensed Operating Instructions	3-6
4-1	Overall Block Diagram	4-1
4-2	1st Local Oscillator	4-7
4-3	1st & 2nd IF Circuit Configuration for Bands 1, 3, 4, 5	4-9
4-4	1st & 2nd IF Circuit Configuration for Band 2	4-11
4-5	1st & 2nd IF Circuit Configuration for Bands 6-8	4-13
4-6	3rd & 4th IF Circuits	4-19
4-7	Video Circuits	4-21
4-8	100 MHz Calibrator	4-23

LIST OF ILLUSTRATIONS (Continued)

Figure	Title	Page
5-1	Components and Adjustments Location	5-2
5-2	Troubleshooting Diagram	5-13
7-1	Comb Generator Test Set-Up	7-17
7-2	Signal Generator Test Set-Up	7-18
7-3	Y202 Second L.O. Test Set-Up	7-18
7-4	Z202 First Mixer and BP-LP Filter Test Set-Up	7-19
7-5	A201 Third Converter Board Test Set-Up	7-19
7-6	Fourth Converter Test Set-Up	7-20
9-1	Microwave Tuning Unit IF Section, Schematic Diagram	9-3
9-2	Microwave Tuning Unit RF Deck, Schematic Diagram	9-7
9-3	3rd Converter Board A201, Schematic Diagram	9-9
9-4	4th Converter Board A202, Schematic Diagram	9-11
9-5	100 KHz B.P. Filter Board A203, Schematic Diagram	9-13
9-6	6.5 MHz Crystal Filter Board A204 & A208, Schematic Diagram	9-15
9-7	LIN-LOG Amplifier Board A205, Schematic Diagram	9-17
9-8	Harmonic Attenuator/Video Filter Duration Board A206, Schematic Diagram	9-19
9-9	100 MHz Calibrator Board A207, Schematic Diagram	9-21
9-10	Phase Lock Module A209, Schematic Diagram	9-23
9-11	RF Board A211, Schematic Diagram	9-25
9-12	IF Attenuator AT202	9-27

LIST OF TABLES

Table No.	Title	Page
1-1	Performance Specifications	1-2
3-1	Frong Panel Controls and Indicators	3-3
3-2	Maximum Safe Input Power Level	3-5
6-1	Performance Checks	6-1
6-2	Performance Check Test Equipment	6-2
7-1	Test Equipment Required for Calibration	7-1

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_05196

Figure 1-1. Systron Donner Model 4809A Microwave Tuning Unit

SECTION I

GENERAL INFORMATION

1-1. SCOPE

This manual provides general information, installation data, operation instructions, circuit descriptions, maintenance data, performance checks, calibration procedures, parts lists, and circuit diagrams for the Model 4809A Microwave Tuning Unit, manufactured by the Systron-Donner Corporation, 14844 Oxnard Street, Van Nuys, California 91411.

The Model 4809A Microwave Tuning Unit, hereinafter referred to as the Model 4809A, is shown in figure 1-1. The unit is installed in a Model 2311 or Model 2312 Display Unit, and functions as the panoramic receiver for a Microwave Spectrum Analyzer System that includes (in addition to the Model 4809A and the display unit) a sweep control unit (Model 4701 or equivalent), and (optionally) a tracking preselector (Model 4745 or equivalent) or other optional accessory.

1-2. DESCRIPTION OF EQUIPMENT

The Model 4809A is a plug-in unit designed for installation in the main frame of the Model 2311 or Model 2312 Display Unit. A locking latch on the front panel operates a locking pin that secures the Model 4809A in the display unit main frame.

Major assemblies of the Model 4809A are the RF deck and the IF section. The IF section is mounted below the RF deck, and includes 8 plug-in printed circuit boards which are accessible with the bottom cover removed. Components mounted on the RF deck are accessible when the RF and IF sections are separated.

External mixers are also provided with the Model 4809A to permit operation over the K, KA, and KU frequency bands.

1-3. CAPABILITIES AND PERFORMANCE

The Model 4809A is intended for multiple laboratory or field uses in connection with communications and surveillance equipment.

Detailed performance specifications for the Model 4809A are given in table 1-1.

Salient features of the system are summarized in the following paragraphs.

1-3.1 EXTERNAL POWER REQUIREMENTS

The Model 4809A obtains all power from the display unit.

1-3.2 FREQUENCY RANGE

The Model 4809A uses the fundamental and harmonics of its internal local oscillator to cover the frequency range from 10 MHz to 40 GHz. This frequency range is covered in eight bands, with band selection accomplished by a front panel control. The frequency reading is indicated on a slide rule dial.

1-3.3 HORIZONTAL DISPLAY

The frequency span on the horizontal (frequency) display is continuously adjustable between 17 calibrated fixed positions of the FREQ SPAN/DIV control between 10 KHz (1 KHz/division) and 2 GHz (200 MHz/division) full scale. A zero span mode is also provided.

1-3.4 VERTICAL DISPLAY

The amplitude display on the vertical axis can be selected as linear or logarithmic. In the linear display mode, the amplitude is a linear function of the detected signal. In the logarithmic display mode, the display amplitude is compressed logarithmically to either 2 or 10 decibels per major division.

1-3.5 STABILIZATION

The first local oscillator is stabilized automatically at FREQ SPAN/DIV settings at and below 500 KHz/division. Stabilized operation of the first local oscillator is indicated by a light on the front panel. A front panel control switch disables the stabilization circuitry when selected.

1-3.6 RESOLUTION BW

Six resolution bandwidths of .1 KHz, .3 KHz, 1 KHz, 10 KHz, 100 KHz and 1000 KHz are provided to permit selection of optimum resolution for the spectrum analysis problem of interest.

1-3.7 INPUT AND IF ATTENUATION

Up to 60 dB of input attenuation in 10 dB steps is provided by a front panel selector switch. A set of six IF attenuation switches provides up to 41 dB of additional attenuation in 1 dB steps. A variable IF attenuation control is also provided, giving an additional 10 dB of attenuation for fine adjustment of system gain.

1-3.8 EXTERNAL MIXERS

Three external wave guide mixers and interconnecting cable are supplied as optional equipment for processing signals in the KU-band (12.4 - 18.0 GHz) K-band (18.0 - 26.0 GHz), and KA-band (26.0 - 40.0 GHz).

TABLE 1-1. PERFORMANCE SPECIFICATIONS

ITEM	PARAMETER	SPECIFICATION
1	Frequency Range:	10 MHz to 40 GHz
2	Center Frequency:	Continuously tunable from 10 MHz to 40 GHz in 8 overlapping bands.
3	Coarse Tuning Accuracy:	NX (±15 MHz), where N is the mixing mode.
4	Fine and Superfine Tuning:	A dual-range fine tuning control on the front panel. The fine tuning range is ±2 MHz, and the superfine tuning range is ±200 KHz nominal.

TABLE 1-1. PERFORMANCE SPECIFICATIONS (Continued)

ITEM	PARAMETER	SPECIFICATION
5	Local Oscillator:	
5.1	Frequency:	2 to 4.1 GHz
5.2	Residual FM:	Less than 10 KHz peak-to-peak at 1 - mixing not stabilized; less than 150 Hz peak-to-peak when stabilized.
5.3	Frequency Stailization:	For frequency spans of 5 MHz full screen or less, the local oscillator is locked to an internal 1 MHz reference signal, unless stabilized operation is overridden by a front panel switch. A panel light indicates when the local oscillator is stabilized.
5.4	Typical Long-Term Drift After 1 Hour @ Constant Temperature:	Stabilized: 10 KHz/10 min. Unstabilized: 50 KHz/10 min for -1 mixing mode
6	Frequency Span:	Selectable from 10 KHz to 2 GHz full screen in 1, 2, 5, 10 sequence by an 18 position front panel rotary switch. Combined frequency span and linearity accuracy is better than ±10% in the calibrated position. Frequency span is continuously adjustable between calibrated positions by means of a vernier control concentric with the FREQ SPAN/DIV switch.
7	Zero Span:	The FREQ SPAN/DIV control has a zero span position. In this setting, the analyzer becomes a tuned receiver with center frequency determined by the main tuning dial. Amplitude variations of the input RF versus time can be displayed on the CRT.
8	Full Span-Sig Ident:	A front panel toggle switch overrides the FREQ SPAN/DIV switch and the tuning dial setting. The local oscillator sweeps across its entire frequency range. A spring-loaded position of the same toggle switch provides a signal identification feature that permits the frequency band of a signal of interest to be identified.
9	Resolution Bandwidth:	The resolution bandwidth of the final IF is switch-selectable at 100 Hz, 300 Hz, 1 KHz, 10 KHz, 100 KHz, or 1 MHz. In addition, an AUTO bandwidth position is provided. In the AUTO position, the optimum bandwidth for the frequency span selected by the FREQ SPAN/DIV switch is selected.

TABLE 1-1. PERFORMANCE SPECIFICATION (Continued)

ITEM	PARAMETER	SPECIFICATION
10	Resolution Bandwidth:	3 dB Bandwidth ±20% / Skirt Selectivity 60: 3 dB Ratio (Typical)
		1 MHz — <7:1
		100 KHz — <8:1
		10 KHz — <9:1
		1 KHz — <10:1
		300 Hz — <11:1
		100 Hz — <11:1
11	Sensitivity:	Minimum CW sensitivity (defined as 3 dB S/N ratio with 1 KHz video BW) at 100 KHz resolution bandwidth
		Band 1: 0.01 to 1.8 GHz — -95 dBm
		Band 2: 1.75 to 3.75 GHz — -98 dBm
		Band 3: 3.01 to 5.0 GHz — -88 dBm
		Band 4: 4.75 to 8.5 GHz — -83 dBm
		Band 5: 8.5 to 12.4 GHz — -80 dBm
		Band 6: 12.4 to 18.0 GHz — -70 dBm
		Band 7: 18.0 to 26.0 GHz — -65 dBm
		Band 8: 26.0 to 40.0 GHz — -55 dBm
12	Frequency Response:	BAND / FLATNESS dB
		1 — ±1
		2 — ±1
		3 — ±1.5
		4 — ±2
		5 — ±2.5
		6 — ±3*
		7 — ±4*
		8 — ±5*
		*Typical with Adjustment of Mixer Bias
13	Display Law:	
13.1	Logarithmic:	Switch-selectable at 2 dB/Div or 10 dB/Div. Calibration accuracy is 0.25 dB/dB, but not more than ±2 dB over dynamic range.
13.2	Linear:	Calibration accuracy is ±5 percent of full screen.

TABLE 1-1. PERFORMANCE SPECIFICATION (Continued)

ITEM	PARAMETER	SPECIFICATION
14	Video Processor:	
14.4	Pulse:	Front panel switch selects post detection peak detector to enhance the display of short duration, or low-PRF pulses.
14.2	Smoothing:	Front panel switch selects 10 KHz or 100 Hz post-detection low-pass filters for noise averaging.
15	Dynamic Range:	Display dynamic range _70 dB. 1 dB compression point -10 dBM typical. Intermodulation products more than 60 dB below two equal -30 dBm signals at least 1 MHz apart with zero RF and IF attenuation.
16	Residual Responses:	Refered to input on 1 - mixing _ -90 dBm typical.
17	Intermodulation:	More than 60 dB below two equal -30 dBm signals at least 1 MHz apart with zero RF and IF attenuation.
18	1 dB Compression Point:	-10 dBm in 10 MHz to 12.4 GHz frequency range; -20 dBm in 12.4 GHz to 40 GHz frequency range.
19	Local Oscillator Emission:	Less than -10 dBm without tracking preselector; less than -80 dBm with tracking preselector.
20	RF Attenuator: (0 to 12.4 GHz)	0 to 60 dB in 10 dB steps. Accuracy is ±0.5 dB or ±2 percent of total attenuation, whichever is greater. Maximum safe input is as follows:

RF Attenuation (dB)	Maximum Safe Input (+dBm)
0	10
10	20
20 to 60	30

21	IF Attenuator:	0 to 41 dB in 1, 2, 3, 5, 10, 20 sequence. Accuracy is 0.1 dB/dB, but less than ±0.5 dB on any step. In addition, a 0 to 10 dB vernier control is provided.
22	RF Input: (0 to 12.4 GHz)	Precision type N connector
22.1	Input Impedance:	50 ohms
22.2	VSWR	Less than 1.5:1 with at least 10 dB of RF attenuation.

TABLE 1-1. PERFORMANCE SPECIFICATION (Continued)

ITEM	PARAMETER	SPECIFICATION
23	RF Input: (12.4 GHz to 40 GHz)	External waveguide mixers are connected to EXT MXR front panel port. Signal input port to mixer is the waveguide flange.
23.1	Bias Voltage:	A variable front panel adjustment is adjusted for optimum conversion efficiency of the external mixer.
23.2	Maximum Safe Input:	+10 dBm.
24	100 MHz Calibrator:	Internal 100 MHz comb generator. The 100 MHz tooth permits amplitude calibration @ -30 dBm.
24.1	Frequency Accuracy	±0.002 percent
24.2	Amplitude Accuracy	±0.2 dB
25	Service Conditions:	Equipment meets performance specifications for Systron-Donner Class B environmental standards.

SECTION II

INSTALLATION

2-1. REMOVAL

2-1.1 Release the latch on the front panel.

2-1.2 Pull the assembled microwave tuning unit and preselector (if attached) straight out of the display unit cavity.

2-2. INSTALLATION

2-2.1 With the preselector (if included) installed on the microwave tuning unit, gently slide the assembly into the cavity of the display unit, until the connectors P201 and P401 engage.

2-2.2 Engage the front panel latch.

2-3. ALIGNMENT

When installing the tuning unit into a display unit, it may be necessary to calibrate the vertical gain, horizontal gain and base line position, using the VERT CAL screwdriver control provided on the front panel of the sweep unit. Refer to the System Alignment procedure in Section VII. If the unit is being used with a Model 4745 Tracking Preselector, refer to the Special Tracking Preselector calibration procedure in Section VII.

SECTION III

OPERATING INSTRUCTIONS

3-1. SCOPE

This section contains descriptions of front panel operating controls and indicators, an initial operating procedure, and a summary of precautions for proper usage of the analyzer.

3-2. FRONT PANEL CONTROLS AND INDICATORS

The front panel controls, indicators, and connectors are illustrated in figure 3-1, and are listed and described in table 3-1.

3-3. CONDENSED OPERATING INSTRUCTIONS (figure 3-2)

Figure 3-2 contains condensed operating procedures for the Model 4809A. These procedures are applicable to most signal analysis problems.

3-4. HINTS AND PRECAUTIONS

Although a spectrum analyzer display is superficially similar to that of a conventional laboratory oscilloscope, this similarity could lead to incorrect use and misinterpretation of the display waveforms. For example, the problem of input overload is not encountered with laboratory oscilloscopes, but is a major concern when using a spectrum analyzer. Other unique problems arise because harmonic mixing is employed to achieve the wide frequency range of the instrument.

3-4.1 INPUT OVERLOAD PROBLEMS

Since the spectrum analyzer may not have a preselection capability, it is very susceptible to input overload, which can produce spurious signals and possible burnout of the crystal input mixer. Replacement of the input mixer is a simple procedure. Refer to applicable instructions.

Unlike the standard oscilloscope, the spectrum analyzer spreads out the input signal power on the horizontal axis, thus, at any given instant, the spectrum analyzer display is responding to only a small part of the total input signal power. The spectrum analyzer front end, however, is responding to the total input signal power at all frequencies. Input overload occurs whenever the strongest frequency component of the input signal exceeds full-scale deflection, or when the input signal power exceeds the dynamic range of the front end. Any attempt to increase the input signal level or to reduce the input attenuation in order to obtain a full-scale display of a small part of the input signal spectrum can result in serious overload. In addition, the dynamic range of the instrument is reduced when IF attenuation is introduced. When IF attenuation is introduced, and the input signal level is then increased so that the frequency component of interest produces full-scale deflection, input overload can result.

To avoid the possibility of an input overload, particularly when the spectrum of the input signal is unknown, proceed as follows:

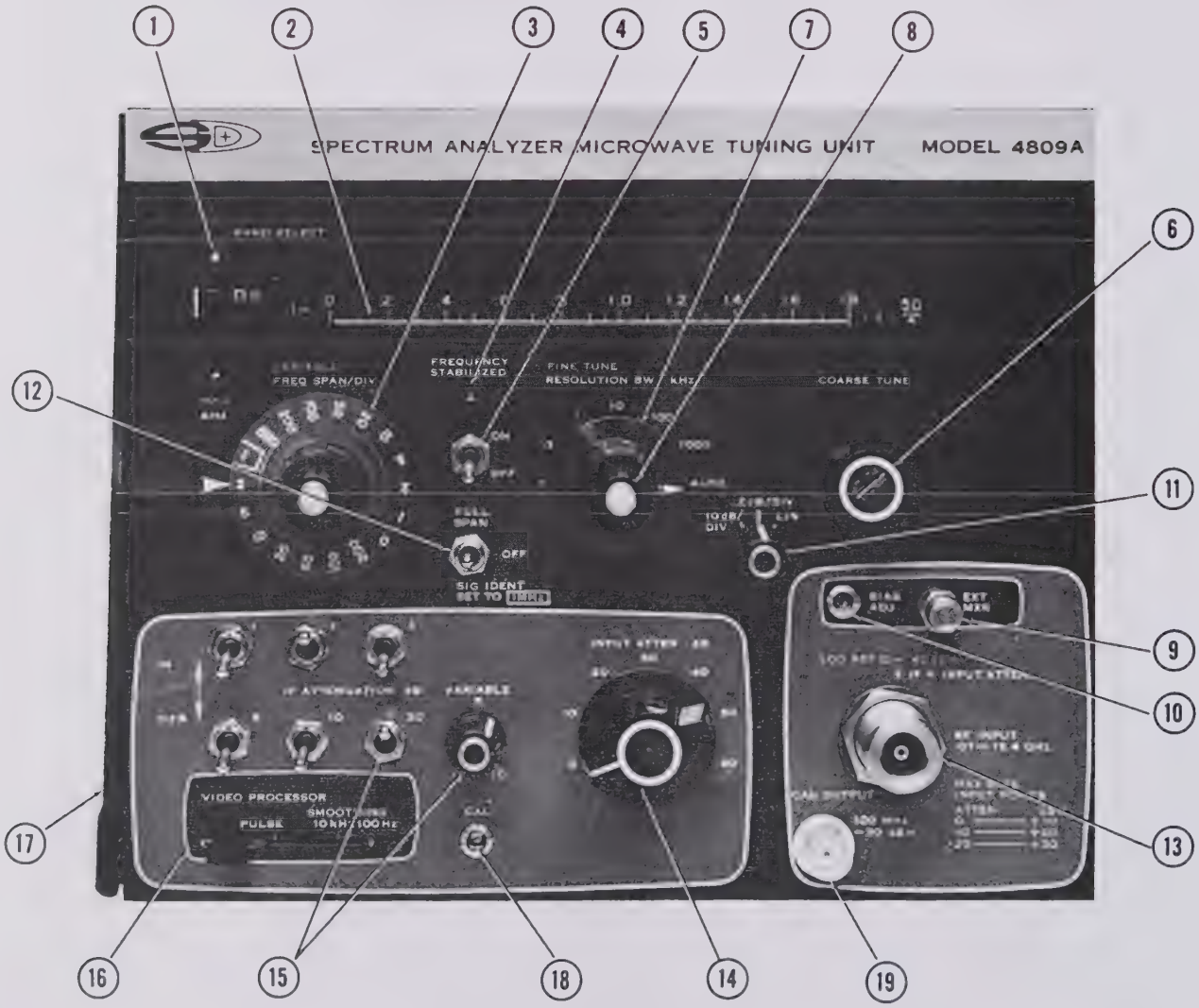


Figure 3-1. Front Panel Controls and Indicators

TABLE 3-1. FRONT PANEL CONTROLS AND INDICATORS

INDEX NO. (Fig. 3-1)	FRONT PANEL NAME AND DESCRIPTION	FUNCTION
1	BAND SELECT thumb control	Selects one of eight frequency bands for calibrated signal analysis.
2	Frequency Scale	Rotating drum frequency dial, having eight separate frequency scales to cover the range from 10 MHz to 40 GHz.
3	FREQ SPAN/DIV concentric selector	This 18-position switch and concentric vernier control (designated VARIABLE) sets the spanwidth of the frequency display on the CRT. The spanwidth of the display, in KHz/division or MHz/division, is indicated for each calibrated position of the FREQ SPAN/DIV switch. The vernier control permits the freq span to be continuously varied between the fixed freq span positions. In the zero span position, the analyzer has the capability as a tuned receiver to display signals in amplitude-versus-time coordinates.
4	FREQUENCY STABILIZED indicator light	This light illuminates when the first local oscillator is stabilized, for frequency spans of less than 1 MHz/div.
5	FREQUENCY STABILIZED toggle switch	When in OFF position, the stabilization circuitry is disabled, for frequency spans of less than 1 MHz/div.
6	COARSE TUNE control	This 10-turn control tunes the analyzer center frequency over the range indicated on the frequency scale. The pointer on the frequency scale indicates the center frequency, which corresponds to the frequency of the signal appearing on the center screen of the CRT display.
7	RESOLUTION BW KHz	Selects the IF bandwidth for the display. 7 positions: .1, .3, 1, 10, 100, 1000 KHz and AUTO.
8	FINE TUNE control	Located concentric with the RESOLUTION BW switch. Dual-range potentiometer permits fine and super-fine adjustment of display frequency.
9	EXT MXR connector	Connector for external mixer cable assembly.

TABLE 3-1. FRONT PANEL CONTROLS AND INDICATORS (Continued)

INDEX NO. (Fig. 3-1)	FRONT PANEL NAME AND DESCRIPTION	FUNCTION
10	BIAS ADJ. screwdriver adjustment	Adjusts external mixer bias current for optimum sensitivity and flatness.
11	DISPLAY LAW switch	Selects the response mode of the video signal. When set to LIN, signal amplitude is linear and left hand graticule scale applies. When set to 10 dB/DIV or 2 dB/DIV position, amplitude is logarithmic and right hand scale in dB applies. 2 dB/DIV increases the resolution of the log scale by a factor of 5.
12	FULL SPAN-SIG IDENT momentary contact toggle switch	If the correct band has been selected and FREQ SPAN/DIV is set to 1 MHz, the signal displayed will move 2 divisions to the left and will be reduced in amplitude approximately 6 dB on alternate sweeps when this control is placed in SIG IDENT position. When placed in FULL SPAN position, the full local oscillator range is swept, overriding the FREQ SPAN/DIV and COARSE TUNE controls.
13	RF INPUT	This type N RF receptacle accepts the input signal to the tuning unit.
14	INPUT ATTEN dB selector switch	Selects seven steps of input attenuation from 0 to 60 dB in 10 dB steps.
15	IF ATTENUATION dB toggle switches and VARIABLE potentiometer	These six toggle switches select IF attenuation in 1 dB steps from 0 to 41 dB. Fine adjustments are accomplished with the 0 to 10 dB VARIABLE control.
16	VIDEO PROCESSOR slide control	This 4-position control selects one of the following: OFF – No video processing is performed. PULSE – Selects post-detection peak detector to enhance the display of short-duration or low-PRF pulses. 10 KHz – Selects post-detection 10 KHz low-pass filter for noise smoothing. 100 Hz – Selects post-detection 100 Hz low-pass filter for noise smoothing.

TABLE 3-1. FRONT PANEL CONTROLS AND INDICATORS (Continued)

INDEX NO. (Fig. 3-1)	FRONT PANEL NAME AND DESCRIPTION	FUNCTION
17	Locking Latch	A single locking lever secures the Model 4809A in the Display Unit.
18	CAL potentiometer	Provides fine adjustment of system gain for amplitude calibration.
19	CAL output	Provides output of internal 100 MHz comb generator used to calibrate the unit in both amplitude and frequency. The 100 MHz tooth has an amplitude of -30 dBm.

3-4.1 (continued)

1. Set the FREQ SPAN/DIV control to 50 MHz, and set all IF ATTENUATION db switches to the down (0 dB) position.

2. Using the INPUT ATTENUATION dB control, set the amount of input signal attenuation so that the strongest signal on the display is closed to, but does not exceed, full scale.

3. When closing in on a signal of interest, do not increase the input signal level above that established in step 2.

4. Do not increase the input signal level after introducing IF attenuation.

A good method for determining whether an input overload or nonlinear condition exists is to introduce 10 dB of input attenuation. The amplitude of the signal of interest should be reduced by 10 dB in the logarithmic display mode. If the amplitude changes by more or less than 10 dB, an input overload is present.

The maximum allowable input signal power that can be applied to the Model 4809A is dependent upon the setting of the INPUT ATTEN - dB control, but should never exceed +30 dBm. Table 3-2 lists the maximum safe input power level that can be applied to the RF INPUT connector. If the input power is allowed to exceed the levels specified in table 3-2, the crystal diode input mixer and/or the input attenuator can be damaged.

TABLE 3-2. MAXIMUM SAFE INPUT POWER LEVEL

INPUT ATTENUATOR SETTING (dB)	MAXIMUM CW INPUT (dBm)
0	+10
10	+20
20-60	+30

A. TYPICAL SIGNAL ANALYSIS WHEN BAND OR INPUT POWER LEVEL IS UNKNOWN

NOTE

If not operating in bands 6 to 8, connect 50-ohm termination to EXT MXR connector (9).

Index No.	Control	Setting	Index No.	Control	Setting
-	Sweeptime control on Sweep Control Unit	AUTO	7	RESOLUTION BW KHz	AUTO
			11	DISPLAY LAW	10 dB/DIV
1	BAND SELECT	1	12	FULL SPAN-SIG IDENT	FULL SPAN
3	FREQ SPAN/DIV	200 MHz with VARIABLE fully CW (off)	14	INPUT ATTEN dB	30
			15	IF ATTENUATION dB	30
6	COARSE TUNE	1.0 GHz	16	VIDEO PROCESSOR	OFF

Step 1. Connect RF input to RF INPUT (13) or EXT MXR (9) connector. Reduce INPUT ATTEN until strongest signal on display is close to (but does not exceed) full-scale. Locate the signal of interest, and perform steps 2 and 3 repetitively until signal of interest is located.

Step 2. Select a band, set FULL SPAN-SIG IDENT to OFF, FREQ SPAN/DIV to 200 MHz, and adjust COARSE TUNE to center the signal of interest on the display.

Step 3. While keeping signal of interest centered with COARSE TUNE, reduce FREQ SPAN/DIV to 1 MHz. Then, set FULL SPAN-SIG IDENT to SIG IDENT. If 6-dB-down image of signal of interest appears two major divisions to the left of the main response, the correct band has been determined. Otherwise, repeat steps 2 and 3 for the next band, and continue until correct band is determined. Proceed to B below.

B. TYPICAL SIGNAL ANALYSIS WHEN BAND AND INPUT POWER LEVEL ARE BOTH KNOWN

NOTE

If not operating in bands 6 to 8, connect a 50-ohm termination to the EXT MXR connector (9).

Step 1. With INPUT ATTEN (14) set to avoid input overload, connect RF input to RF INPUT (13) or EXT MXR (9) connector.

Index No.	Control	Setting	Index No.	Control	Setting
-	Sweeptime control on Sweep Control Unit	AUTO	7	RESOLUTION BW KHz	AUTO
			11	DISPLAY LAW	10 dB/DIV
3	FREQ SPAN/DIV	200 MHz with VARIABLE fully CW (off)	12	FULL SPAN-SIG IDENT	OFF
			15	IF ATTENUATION dB	Set for a good display
5	FREQUENCY STABILIZED	OFF			
6	COARSE TUNE	Set so that signal of interest is centered	16	VIDEO PROCESSOR	OFF

Figure 3-2. Condensed Operating Instructions (1 of 2)

Step 2. Close in on the signal of interest by reducing the setting of the FREQ SPAN/DIV switch while keeping the signal of interest centered with COARSE and FINE TUNE (8) controls. After optimum frequency span is obtained, set sweeptime, DISPLAY LAW, IF ATTENUATION, RESOLUTION BW, and VIDEO PROCESSOR controls of optimum amplitude display. If FREQ SPAN/DIV is less than 1 MHz, set FREQUENCY STABILIZED switch to ON if stabilized operation is desired. FREQUENCY STABILIZED indicator (4) should light. If operating in bands 6 to 8, adjust BIAS ADJ screw-driver adjust (10) for peak response.

C. CALIBRATION CHECK

Index No.	Control	Setting	Index No.	Control	Setting
-	Sweeptime control on Sweep Control Unit	3 msec/div free-running sweep	11	DISPLAY LAW	2 dB/DIV
			12	FULL SPAN-SIG IDENT	OFF
1	BAND SELECT	1	14	INPUT ATTEN dB	10
2	FREQ SPAN/DIV	10 MHz with VARIABLE set fully CW (off)	15	IF ATTENUATION dB	0
			16	VIDEO PROCESSOR	100 Hz
			15	IF ATTENUATION VARIABLE	0
5	FREQUENCY STABILIZED	OFF	9	Connect 50-ohm to EXT MXR connector.	
6	COARSE TUNE	.100 GHz			
7	RESOLUTION BW KHz	100 KHz			

Step 1. Connect cable from CAL OUTPUT connector (19) to RF INPUT connector (13). Adjust COARSE TUNE (6) and FINE TUNE (8) controls to center the 100 MHz comb line on the display.

Step 2. Set INPUT ATTEN to 10 dB, and adjust CAL screwdriver adjust (18) for full-scale deflection of the 100 MHz comb line.

Step 3. Increase INPUT ATTEN to 30 dB, and adjust vertical calibration control on Sweep Control Unit so that signal peak is down 5 major divisions (10 dB) full-scale.

Step 4. Repeat steps 2 and 3 as required.

Step 5. Set INPUT ATTEN to 10 dB, DISPLAY LAW to 10 dB/DIV. The 100 MHz signal peak shall be at full-scale.

Step 6. Turn IF ATTENUATION VARIABLE control to 10. The 100 MHz signal peak shall be at -10 dB on the right-hand graticule scale.

Step 7. Return IF ATTENUATION VARIABLE to 0, and set FULL SPAN-SIG IDENT to FULL SPAN. Observe that 19 $\pm$1 comb teeth appear on the display.

Figure 3-2. Condensed Operating Instructions (2 of 2)

3-4.2 SWEEP TIME, FREQ SCAN, AND RESOLUTION BW SELECTION

Because the spectrum analyzer is a swept instrument, the input Display Amplitude is affected by the display sweep time and the resolution bandwidth. Normally, the sweep-time is set for the fastest rate consistent with the input signal characteristics, the setting of the FREQ SPAN/DIV switch, and the setting of the RESOLUTION BW switch. If the sweep time is increased above the optimum value, the spectrum analyzer becomes over-resolved, causing the input signal amplitude on the display to decrease. If the input signal level is then increased to restore full-scale deflection, input overload will result. A simple method to determine if the signal is over-resolved is to decrease the sweep-time. If the amplitude of the signal increases as the sweep-time is decreased, an over-resolved condition exists.

3-5. OPERATING MODES

The operating modes of the Model 4809A are selected at the front panel of the Model 4809A and the front panel of the Model 4701 (or equivalent) Sweep Control Unit.

3-5.1 FREQUENCY SPAN MODES

3-5.1.1 ZERO SPAN MODE

This mode is selected when the Model 4809A FREQ SPAN/DIV switch is set to 0, or when the μS (fast sweep) mode is selected at the Model 4701. No dispersion sweep is supplied to the Model 4809A, and the spectrum analyzer is used as an ordinary superheterodyne receiver that is tuned to the frequency of the signal of interest. The CRT display (amplitude on the vertical axis, time on the horizontal axis) is similar to that of conventional oscilloscope, and consists of the detected video pulse whose carrier frequency is equal to the center frequency indicated on the tuning dial. Normally, the horizontal sweep of the CRT is synchronized to an external sync signal, or to the video pulses themselves. The PULSE position of the VIDEO PROCESSOR switch enhances the pulse display. The bandwidth of the display is established by the RESOLUTION BW switch.

3-5.1.2 FULL SPAN/SIGNAL IDENT MODE

This mode is normally used to locate a signal of interest in the 10 MHz to 40 GHz range. Initially, the settings of the FREQ SPAN/DIV, BAND SELECT, and frequency tune controls are irrelevant. The FULL SPAN-SIG IDENT switch is first operated to the FULL SPAN position. Each dispersion sweep will then cause the 1st local oscillator to sweep across the full 2 GHz range. Harmonic mixing will cause any signal in the 10 MHz to 40 GHz range to appear on the CRT. The location (distance to the left or right of center) of the signal of interest can then be used to determine the approximate setting of the frequency tune controls to center the signal on the CRT. Then, with the FREQ SPAN/DIV switch set to 1 MHz per division, the FULL SPAN-SIG IDENT switch is set to SIG IDENT. A reduced amplitude (6 dB down) image of the signal of interest will appear to the right or left of the signal of interest on alternate sweeps. The BAND SELECT switch is then operated to the position where the image signal is displaced two major divisions to the left of the signal of interest. Since the correct band has been chosen, the frequency of the signal of interest can then be read directly from the tuning dial, by switching the FULL SPAN-SIG IDENT switch to OFF and tuning the Model 4809A to center the signal of interest on the display.

3-5.1.3 WIDE-SPAN MODE

The wide-span mode is always selected when the FREQ SPAN/DIV switch is set for a span-width of 1 MHz per division or greater. In this mode, the dispersion sweep signal from the display unit is attenuated by the appropriate amount (as determined by the settings of the BAND SELECT and FREQ SPAN/DIV switches) and applied as the main tuning signal to the 1st local oscillator. Stabilized operation cannot be selected in the wide-span mode. The center frequency of the dispersion sweep is determined by the setting of the COARSE TUNE control, as indicated on the tuning dial. Fine tuning is accomplished by varying the FINE TUNE control, which adjusts the frequency of the 3rd local oscillator.

3-5.1.4 NARROW-SPAN MODE

The narrow-span mode is always selected when the FREQ SPAN/DIV switch is set for a span-width of less than 1 MHz per division. In this mode, the dispersion sweep signal from the display unit is attenuated by the appropriate amount (as determined by the setting of the FREQ SPAN/DIV switch) and applied as the tuning signal to the 3rd local oscillator. The 1st local oscillator produces a fixed-frequency output established by the FREQUENCY TUNE controls. Stabilized operation is normally used, and is selected by setting the FREQUENCY STABILIZED switch to the up (on) position. This action causes the 1st local oscillator to be locked to a harmonic of a 1 MHz reference signal so as to stabilize the 1st local oscillator. When the 1st local oscillator is phase-locked, the FREQUENCY STABILIZED indicator illuminates.

3-5.2 AUTOMATIC MODE

In this mode, the sweep control unit is set to AUTO, and the RESOLUTION-BW switch on the Model 4809A is set to AUTO. In the automatic mode, the resolution bandwidth and video filtering are determined by the FREQ SPAN/DIV switch setting. Also, the horizontal sweep rate (sweep time per division) in the sweep control unit is optimized.

3-5.3 DISPLAY LAW AND VIDEO PROCESSING MODES

The DISPLAY LAW switch selects either a linear or logarithmic amplitude display on the CRT. For a linear display, the left-hand vertical graticule of the CRT display is used. For a logarithmic display, the right-hand graticule is used, and the position of the DISPLAY LAW switch determines whether the scaling per major division is 2 dB or 10 dB.

The VIDEO PROCESSOR switch can be set to OFF (no video processing), PULSE (enhances display of pulses), or the 10 KHz or 100 Hz video smoothing positions (provide noise averaging to improve measurement of low-level signals which otherwise might be obscured by noise at a wide resolution bandwidth setting).

3-6. CALCULATING THE AMPLITUDE OF A SIGNAL OF INTEREST

When the Model 4809A is properly calibrated, the log reference level corresponding to full-scale deflection in the logarithmic (dB/Div) DISPLAY LAW mode is -40 dBm with no RF or IF attenuation. The absolute amplitude of the signal of interest is calculated as follows (with DISPLAY LAW switch set to 10 dB/Div or 2 dB/Div):

$$\text{Absolute Amplitude (dBm)} = \left[\text{dB below Full Scale LOG REF}\right] - \left[40 + \text{RF Atten.} + \text{IF Atten. (switches)} + \text{IF Atten. (Variable)}\right]$$

3-7. USE OF THE INTERNAL 100 MHZ CALIBRATOR

By connecting the output of the 100 MHz Calibrator (19, figure 3-1) to the RF INPUT connector, a 100 MHz comb display can be obtained, in which the first (100 MHz) tooth of the comb has an amplitude of -30 ±0.2 dBm. The comb display can be used to calibrate the Model 4809A in both amplitude and frequency. Amplitude calibration is accomplished using the front panel CAL potentiometer for signal deflection to the proper vertical division (depending on IF and RF attenuation, see para 3-6). Frequency calibration is accomplished by using the 100 MHz comb as 100 MHz markers while adjusting the HORZ. CALIBRATION on the Display Unit. Example: FREQ SPAN/DIV set to 100 MHz and RESOLUTION BW set to AUTO, adjust the HORZ. CALIBRATION for 1 major division between comb lines.

SECTION IV

CIRCUIT DESCRIPTION

4-1. OVERALL FUNCTION DESCRIPTION (figure 4-1)

Figure 4-1 is a simplified block diagram of the Model 4809A Microwave Tuning Unit.

Basically, the spectrum analyzer is an electronically tuned, multiple conversion, superheterodyne receiver with a CRT display that indicates signal amplitude as a function of frequency. The frequency spectrum display along the horizontal axis of the CRT is produced by linearly tuning the Model 4809A receiver local oscillator frequency in synchronism with the horizontal deflection voltage for the CRT in the display unit. This dispersion sweep of the local oscillator is analogous to manually tuning a convetional receiver across a frequency band, and measuring received signal amplitude at each point in the tuning range. The automatic dispersion sweep of the Model 4809A, synchronized with the horizontal deflection voltage for the CRT, produces a graphic portrayal of signal amplitude versus frequency over an operator-selected frequency range.

The Model 4809A receives the RF signal input whose frequency spectrum is to be analyzed, and produces video whose amplitude is proportional to RF signal amplitude at any given frequency in the frequency range being examined. The frequency range is from 10 MHz to 40 GHz, and is divided into 8 bands (bands 1 through 8).

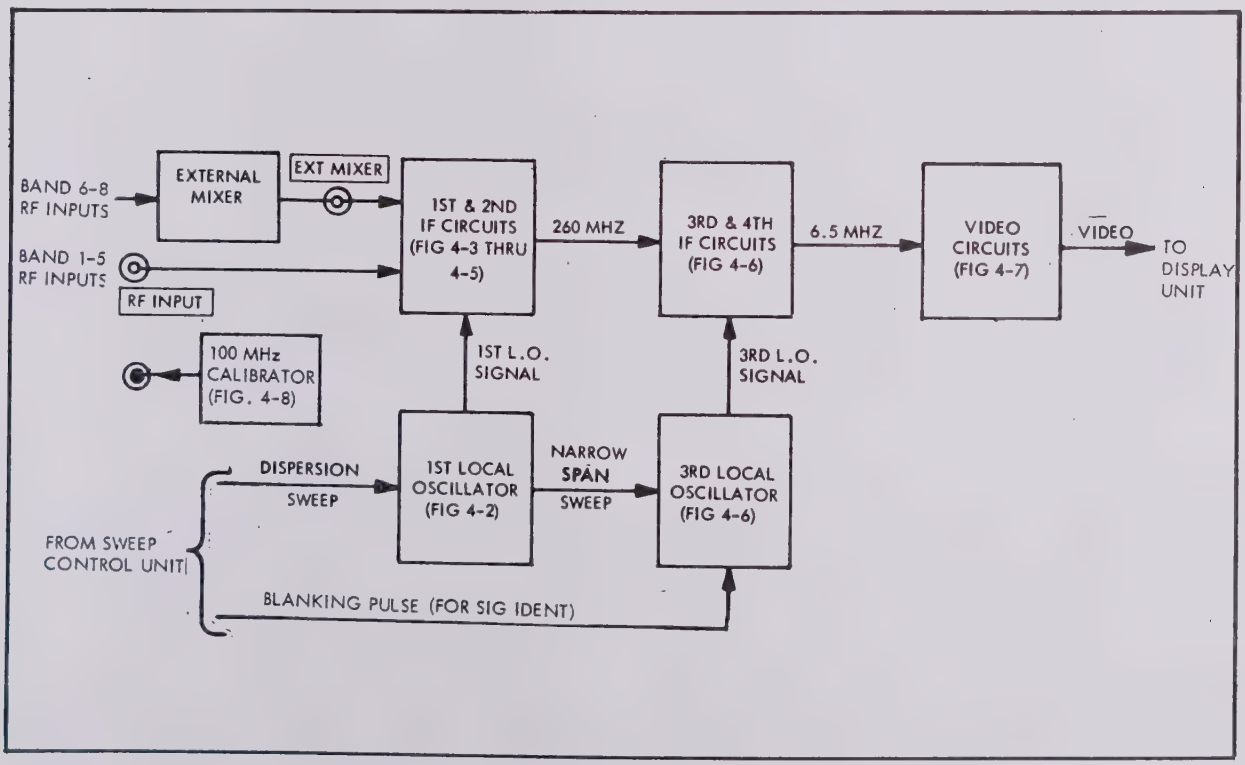


Figure 4-1. Overall Block Diagram

RF inputs in bands 1 through 5 (.01 to 12.4 GHz) are applied to the 1st and 2nd IF circuits via the RF INPUT front panel jack.

RF inputs in bands 6 through 8 (12.4 to 40 GHz) are applied to an external mixer connected to the EXT MXR front panel jack. The 1st local oscillator signal is coupled to the external mixer via the EXT MXR jack, and the appropriate harmonic (determined by the frequency band) of the local oscillator signal is mixed with the RF input signal, producing a 2.05 GHz IF signal that is supplied bach through the EXT MXR jack to the 1st and 2nd IF circuits.

The RF signal from the input attenuator (bands 1 through 5) or from the external mixer (bands 6 through 8) is then processed by the first, second, third, and fourth IF circuits, and the fourth IF signal is applied to video circuits that produce the vertical deflection input to the Display Unit.

The center frequency of the Model 4809A is established by the frequency tune controls on the front panel, and is indicated in the tuning dial window. This center frequency is related to the center frequency of the 1st local oscillator.

A derivative (obtained from the sweep control unit) of the sweep sawtooth used to drive the horizontal deflection circuits in the display unit is supplied as the dispersion sweep signal to the Model 4809A. Except in the fast sweep mode (no dispersion sweep), this dispersion sweep signal is applied to either the 1st or 3rd local oscillator, depending upon the setting of the FREQ SPAN/DIV switch. For spanwidths of 1 MHz per division or greater (wide-span sweeps), the dispersion sweep sawtooth is applied to the 1st local oscillator. For spanwidths of less than 1 MHz per division (narrow-span sweep), the dispersion sweep sawtooth is applied to the 3rd local oscillator.

The local oscillator which receives the dispersion sweep signal is swept across a frequency range established by the FREQ SPAN/DIV and BAND SELECT switch settings. This dispersion sweep causes the local oscillator output frequency to increase linearly as the CRT beam is deflected from left to right across the display. The center position on the display corresponds to the center frequency established by the frequency tune controls.

The swept local oscillator output is applied to a mixer where it is mixed with the input signal (or a derivative of the input signal) being analyzed. The mixing action produces sum and difference signal components. The difference signal products are defined as follows:

$$f_{dif} = f_{sig} - nf_{lo},\ nf_{lo} - f_{sig} \qquad (1)$$

Where:

f_{dif} = the frequency of the difference signal

f_{sig} = the frequency of the RF input (signal being analyzed)

f_{lo} = the frequency of the swept local oscillator at any given instant

n = the harmonic of the local oscillator frequency (1st, 2nd, 3rd, etc., harmonic)

As the local oscillator sweeps across the frequency range established by the frequency tune controls and the dispersion sweep signal, a point will be reached where a difference signal equal to the associated IF frequency is produced. The Model 4809A produces a video output only when the difference signal is equal to the associated IF frequency, consequently, a video output is produced for each frequency component of the signal being analyzed which is in the range established by the first local oscillator center frequency and the dispersion sweep sawtooth.

The video output for each frequency component is applied to the vertical deflection circuits in the display unit, producing vertical deflections whose amplitudes are propertional to the relative power of each frequency component. The vertical deflection for a particular frequency component occurs at the point on the horizontal sweep where:

$$nf_{lo} = f_{sig} \pm f_{if} \qquad (2)$$

Where:

f_{if} = the intermediate frequency associated with the mixer stage where the signal of interest is mixed with the swept local oscillator signal

f_{sig} = the frequency of particular frequency component in the signal of interest

That is, when the swept local oscillator reaches a frequency (nf_{lo}) which is equal to the frequency of the signal of interest plus or minus the IF frequency (f_{if}), the resulting mixer output will produce a vertical deflection. Since the local oscillator and the CRT horizontal deflection are swept in synchronism, the horizontal position on the display defines the frequency of the signal of interest.

The tuning range of the 1st local oscillator is 2.0 to 4.1 GHz. To cover the frequency range from 10 MHz to 40 GHz, the first, second, third, fourth, sixth, and tenth harmonics (n = 1, 2, 3, 4, 6, 10) of the first local oscillator are utilized. The selected harmonic is determined by the position of the BAND SELECT control (bands 1 through 8), which selects the harmonic number being utilized. The band number (1 through 8) is indicated on the BAND SELECT switch. The selected harmonic number is indicated in the tuning window for each band, as follows:

Band	Harmonic (n =)
1	1-
2	1-
3	2-
4	3-
5	3+
6	4+
7	6+
8	10+

For bands 1, 3, 4, 5, 6, 7, and 8, the selected harmonic of the 1st local oscillator is mixed with the RF input to produce a first IF frequency of 2.050 GHz. For band 2, the first harmonic is mixed with the RF input to produce a first IF frequency of

260 MHz. In the wide-span sweep positions of the FREQ SPAN/DIV switch (1 MHz per division or above), nf_{lo} in equation (2) is the frequency of the selected harmonic of the 1st local oscillator, f_{sig} in equation (2) has a frequency of 10 MHz to 40 GHz, and f_{if} is 2.050 GHz (bands 1, 3, 4, 5, 6, 7, or 8) or 260 MHz (band 2).

In the narrow-span positions of the FREQ SPAN/DIV switch (less than 1 MHz per division), nf_{lo} in equation (2) is the fundamental frequency (n = 1) of the swept 3rd local oscillator, f_{sig} has a frequency of 262 ± 5 MHz, and f_{if} is 60 MHz. The maximum tuning range of the 3rd local oscillator is 197 MHz to 207 MHz (202 = ±5 MHz).

The width of the dispersion sweep is determined by the setting of the BAND SELECT (wide-span only) and FREQ SPAN/DIV switches, and is varied by attenuating the dispersion sweep sawtooth applied to the local oscillator being swept. When the FULL SPAN-SIG IDENT switch is operated to the FULL SPAN position, the 1st local oscillator is swept across the entire 2 - 4 GHz range, regardless of the setting of the FREQ SPAN/DIV switch or BAND SELECT switch.

The bandwidth of the final (4th) IF frequency (6.5 MHz) is determined by the setting of the RESOLUTION BW KHz switch. In the narrow bandwidth settings, resolution of discrete frequency components in the signal of interest can be accomplished. An IF attenuator, controlled by front-panel switches, permits the 6.5 MHz IF signal to be attenuated by as much as 41 dB before video detection is performed. The VARIABLE IF attenuator potentiometer provides additional control of IF attenuation. Either linear or logarithmic video detection may be selected.

The VIDEO PROCESSOR control on the front panel provides video filters when set to the 10 KHz or 100 Hz position. When set to the PULSE position, displays of narrow pulse signals can be enchanced.

4-2. DETAILED FUNCTIONAL DESCRIPTIONS

As shown in figure 4-1, the major functional elements of the Model 4809A are the 1st local oscillator, the 1st and 2nd IF circuits, the 3rd local oscillator, the 3rd and 4th IF circuits, the video circuits, and the 100 MHz calibrator. The figure number of the detailed block diagram showing each of these elements is indicated in figure 4-1. The succeeding subparagraphs provide detailed block diagram descriptions for each of the major functional elements. The location (reference designation) of each element is indicated on the detailed block diagrams.

4-2.1 1ST LOCAL OSCILLATOR (figure 4-2)

Oscillator Y201 is a YIG-tuned oscillator whose frequency is controlled by the main tuning current and the phase lock tuning current (narrow-span mode only). The 1st local oscillator output is supplied through the isolator AT203 and 20 dB coupler DC201 to the 1st and 2nd IF circuits.

4-2.1.1 OPERATION OF 1ST LOCAL OSCILLATOR IN WIDE-SPAN MODE

In the wide-span mode, the oscillator center frequency is established by FREQUENCY TUNE control R201, and the wide-span sweep signal controls the tuning range. The wide-span sweep signal is derived as follows:

1. The dispersion sweep signal from the sweep control unit is supplied to the harmonic attenuator (part of board A206), which also receives switch selection signals from the BAND SELECT switch. The sawtooth-shaped dispersion sweep signal is attenuated in the harmonic attenuator by an amount (inversely proportional to the harmonic number) determined by the selected band, producing the wide-span sweep signal.

2. The wide-span sweep signal is then applied to the FREQ SPAN/DIV switch, scaled according to the selected spanwidth, and supplied to the sweep summing junction on board A211.

The sweep summing junction on board A211 receives the wide-span sweep signal and the d-c output of the COARSE TUNE control. The resulting input to the sweep driver (which produces the main tuning current) is a sawtooth voltage centered on the d-c voltage from the COARSE TUNE control.

4-2.1.2 OPERATION OF 1ST LOCAL OSCILLATOR IN FULL SPAN

When the FULL SPAN-SIG IDENT switch (S203) is set to FULL SPAN, the harmonic attenuator is disabled, permitting the unattenuated sawtooth from the display unit to be applied (via the harmonic attenuator) through switch S203 to the sweep summing junction. The input from the COARSE TUNE control to the sweep summing junction is disabled, thus the resulting input to the sweep driver is a sawtooth voltage centered on the d-c voltage that corresponds to the 3 GHz center frequency of the 1st local oscillator. The sawtooth voltage causes the 1st local oscillator to sweep across its entire frequency range (2 to 4 GHz).

4-2.1.3 OPERATION OF 1ST LOCAL OSCILLATOR IN NARROW SPAN MODE

In the narrow-span mode, the narrow span enable signal is at -15 vdc, disabling the harmonic attenuator to permit the unattenuated sawtooth from the display unit to be applied (via the harmonic attenuator) to the FREQ SPAN/DIV switch. The amount of attenuation of the sawtooth voltage is then determined by the setting of the FREQ SPAN/DIV switch. The resulting narrow-span sweep signal is applied to the 3rd local oscillator. The wide-span sweep signal from the FREQ SPAN/DIV switch is interrupted, thus no dispersion sweep signal is applied to the 1st local oscillator. Consequently, the main tuning current for the 1st local oscillator is controlled soley by the COARSE TUNE control, and no frequency sweep occurs. If FREQUENCY STABILIZED switch S206 is set to the up (ON) position, the phase lock detector (A209) is enabled, and a sample of the Y201 output is supplied as a feedback signal through isolator AT203 and 20 dB coupler DC201 to the phase lock detector. The phase lock detector compares the phase of the feedback signal with the phase of the nearest harmonic of a 1 MHz reference oscillator. If the phase relationship is incorrect, the resulting error signal activates a search oscillator in the phase lock detector, producing a phase lock tuning current for Y201. This tuning current produces small changes in oscillator frequency. When the correct phase relationship is obtained, the search oscillator stops, and the FREQUENCY STABILIZED indicator lights to indicate that the 1st local oscillator is phase-locked. Selection of the narrow-span mode also energizes a noise filter relay that is part of the sweep driver circuit on Board A211. With the relay energized, the noise filter circuit eliminates fluctuations in the main tuning current of the 1st L.O.

4-2.2 1ST AND 2ND IF CIRCUITS

The 1st and 2nd IF circuits receive the RF input and the output of the 1st local oscillator, and convert the RF input to a 260 MHz IF signal. The configuration of the 1st and 2nd IF circuits depends upon the selected band, as described in the succeeding subparagraphs.

4-2.2.1 1ST AND 2ND IF CIRCUIT CONFIGURATION FOR BANDS 1, 3, 4, AND 5 (figure 4-3)

When band 1, 3, 4, or 5 is selected, the RF input is applied through the RF INPUT front panel jack to RF attenuator AT201. The amount of attenuation produced by AT201 is controlled by an INPUT ATTEN dB switch on the front panel. The attenuated RF output from AT201 is applied through RF coaxial switch S208 and DC blocking capacitor Z204 to 1st IF mixer Z202. The 1st local oscillator signal is also applied through switch S208 to mixer Z202. The resulting 1st difference frequency output (2.050 GHz) from Z202 is applied through the normally closed contact of waveguide coaxial switch K201 to bandpass filter FL201. The resulting narrow-band 2.050 GHz 1st IF signal from FL201 is applied back through switch S208 to 2nd IF mixer Z203. Mixer Z203 also receives (via switch S208) the 1.79 GHz 2nd local oscillator signal from fixed-frequency oscillator Y202. The resulting 260 MHz difference frequency output of Z203 is applied through 260 MHz amplifier AR201 to the 3rd and 4th IF circuits.

4-2.2.2 1ST AND 2ND IF CIRCUIT CONFIGURATION FOR BAND 2 (figure 4-4)

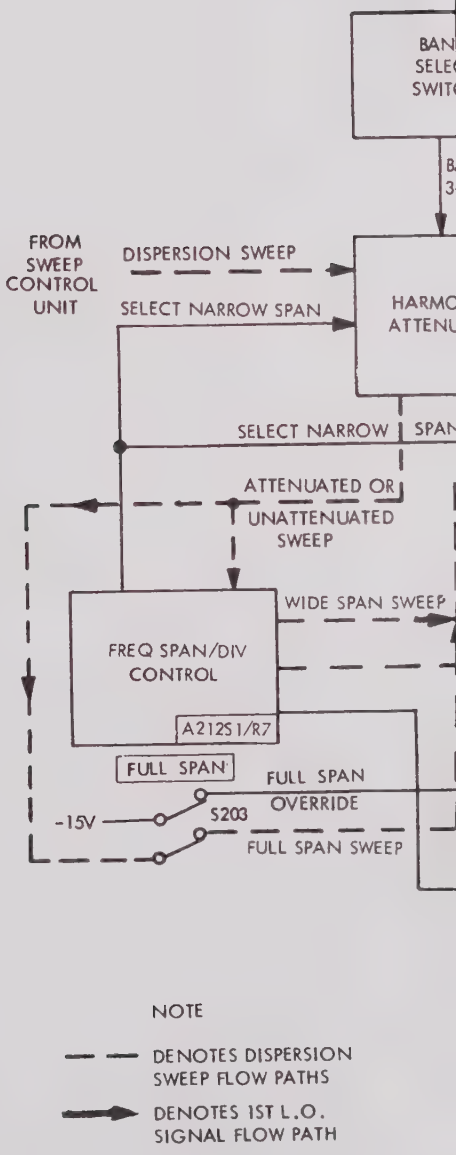
When band 2 is selected, the RF input is applied through the RF INPUT front panel jack to RF attenuator AT201. The amount of attenuation produced by AT201 is controlled by an INPUT ATTEN dB switch on the front panel. The attenuated RF input from AT201 is applied through RF coaxial switch S208 to 2nd IF mixer Z303. Mixer Z303 also receives (via switch S208) the 1st local oscillator signal. The resulting 260 MHz difference frequency output of Z203 is applied through 260 MHz amplifier AR201 to the 3rd and 4th IF circuits.

4-2.2.3 1ST AND 2ND IF CIRCUIT CONFIGURATION FOR BANDS 6 THROUGH 8 (figure 4-5)

For bands 6 through 8, the RF input is connected to an external mixer (type K, KU or KA, depending upon the band in which the RF signal is contained). The 1st local oscillator signal is applied through RF coaxial switch S208, 1st IF mixer Z202, circulator HY201, external mixer bias block Z201, the EXT MIXER front panel jack, and a 3 dB pad to the external mixer. The resulting 1st difference frequency output (2.050 GHz) produced by the mixing action in the external mixer is supplied back through 3 dB pad and the EXT MXR front panel jack to external mixer bias block Z201. The bias voltage applied to the bias block from BIAS control R202 is set for optimum conversion efficiency of the external mixer. The 2.050 GHz IF signal from Z201 is applied through circulator HY201 and the normally open contact of waveguide coaxial switch K201 to bandpass filter FL201. The resulting narrow-band 2.050 GHz 1st IF signal from FL201 is applied back through switch S208 to 2nd IF mixer Z203. Mixer Z203 also receives (via switch S208) the 1.79 GHz 2nd local oscillator signal from fixed-frequency oscillator Y202. The resulting 260 MHz difference frequency output of Z203 is applied through 260 MHz amplifier AR201 to the 3rd and 4th IF circuits.

4-2.3 3RD AND 4TH IF CIRCUITS (figure 4-6)

The 3rd and 4th IF circuits receive the 260 MHz IF signal from the 1st and 2nd IF circuits, and convert this input to a 6.5 MHz IF signal that is supplied to the video circuits.


FROM SWEEP CONTROL UNIT
DISPERSION SWEEP
SELECT NARROW SPAN
SELECT NARROW
ATTENUATED OR UNATTENUATED SWEEP
WIDE SPAN SWEEP
FREQ SPAN/DIV CONTROL
A21251/R7
FULL SPAN
FULL SPAN OVERRIDE
S203
-15V
FULL SPAN SWEEP
NOTE
DENOTES DISPERSION SWEEP FLOW PATHS
DENOTES 1ST L.O. SIGNAL FLOW PATH

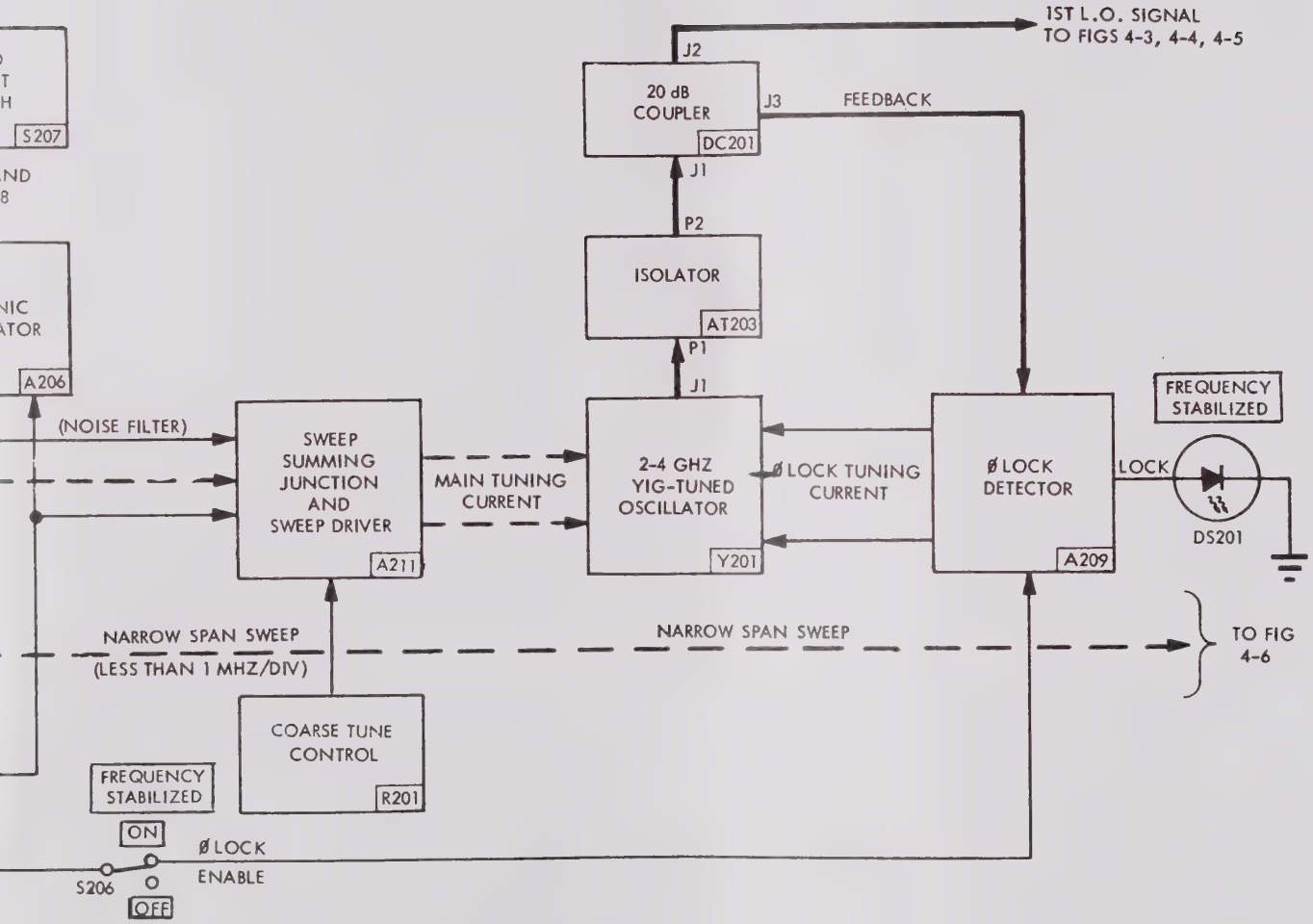
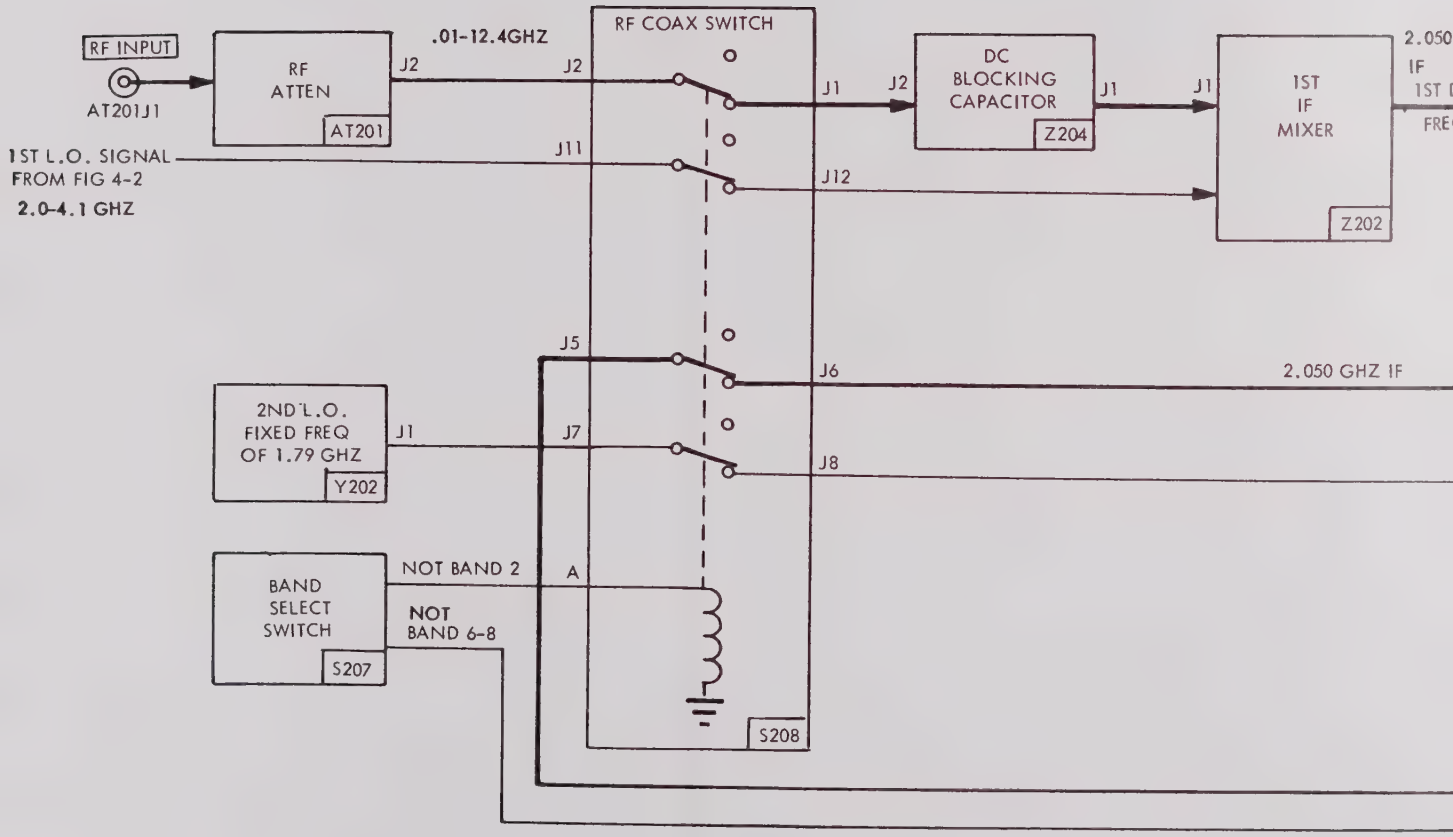


Figure 4-2. 1st Local Oscillator


RF INPUT
AT201J1
RF ATTEN
AT201
.01-12.4GHZ
J2
J2
RF COAX SWITCH
1ST L.O. SIGNAL
FROM FIG 4-2
2.0-4.1 GHZ
J11
J1
J2
DC BLOCKING CAPACITOR
Z204
J1
J1
1ST IF MIXER
Z202
2.050
IF
1ST
FRE
J12
J5
J6
2.050 GHZ IF
2ND L.O. FIXED FREQ OF 1.79 GHZ
Y202
J1
J7
J8
BAND SELECT SWITCH
S207
NOT BAND 2
A
NOT BAND 6-8
S208

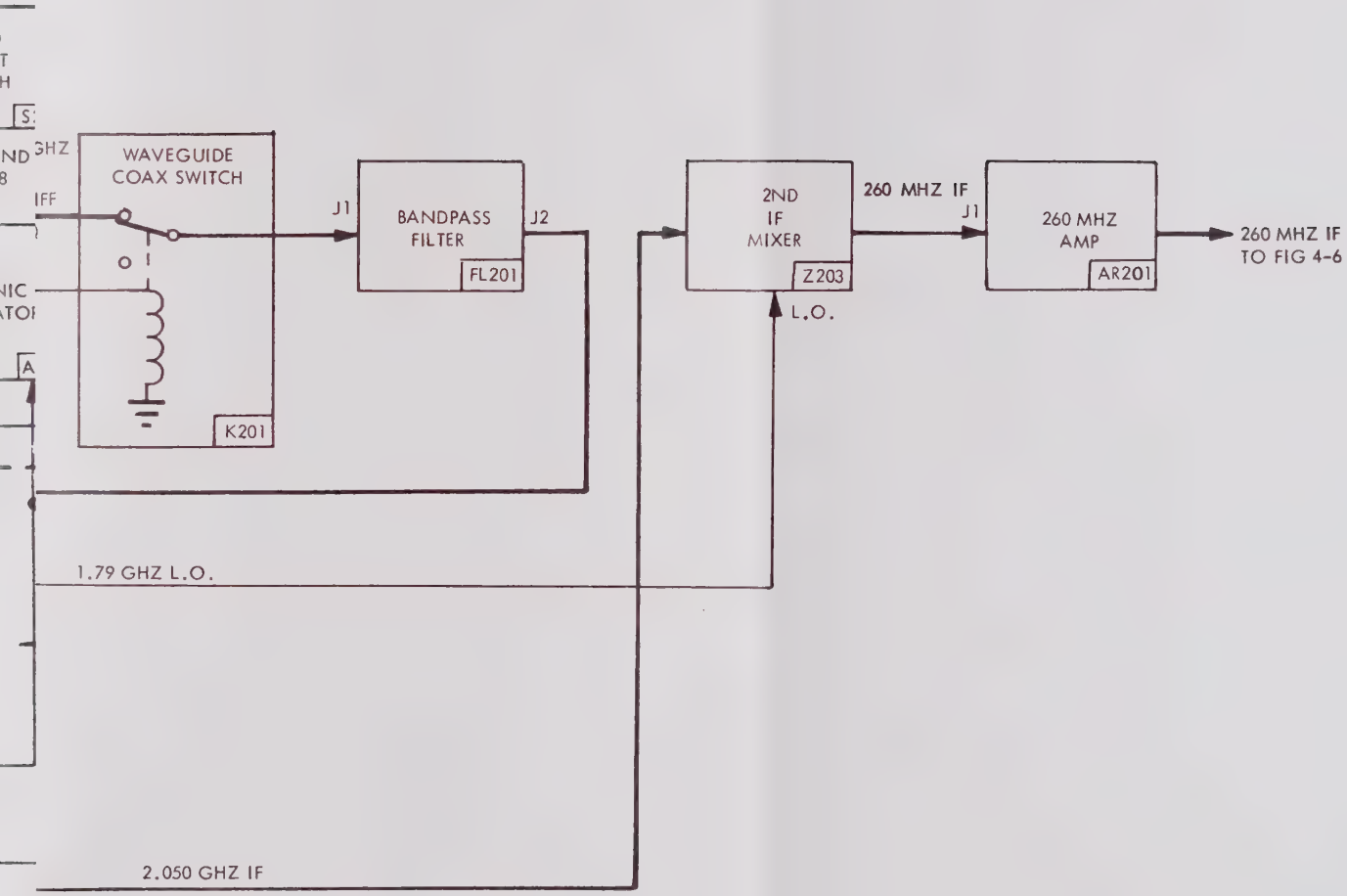


Figure 4-3. 1st & 2nd IF Circuit Configuration for Bands 1, 3, 4, 5

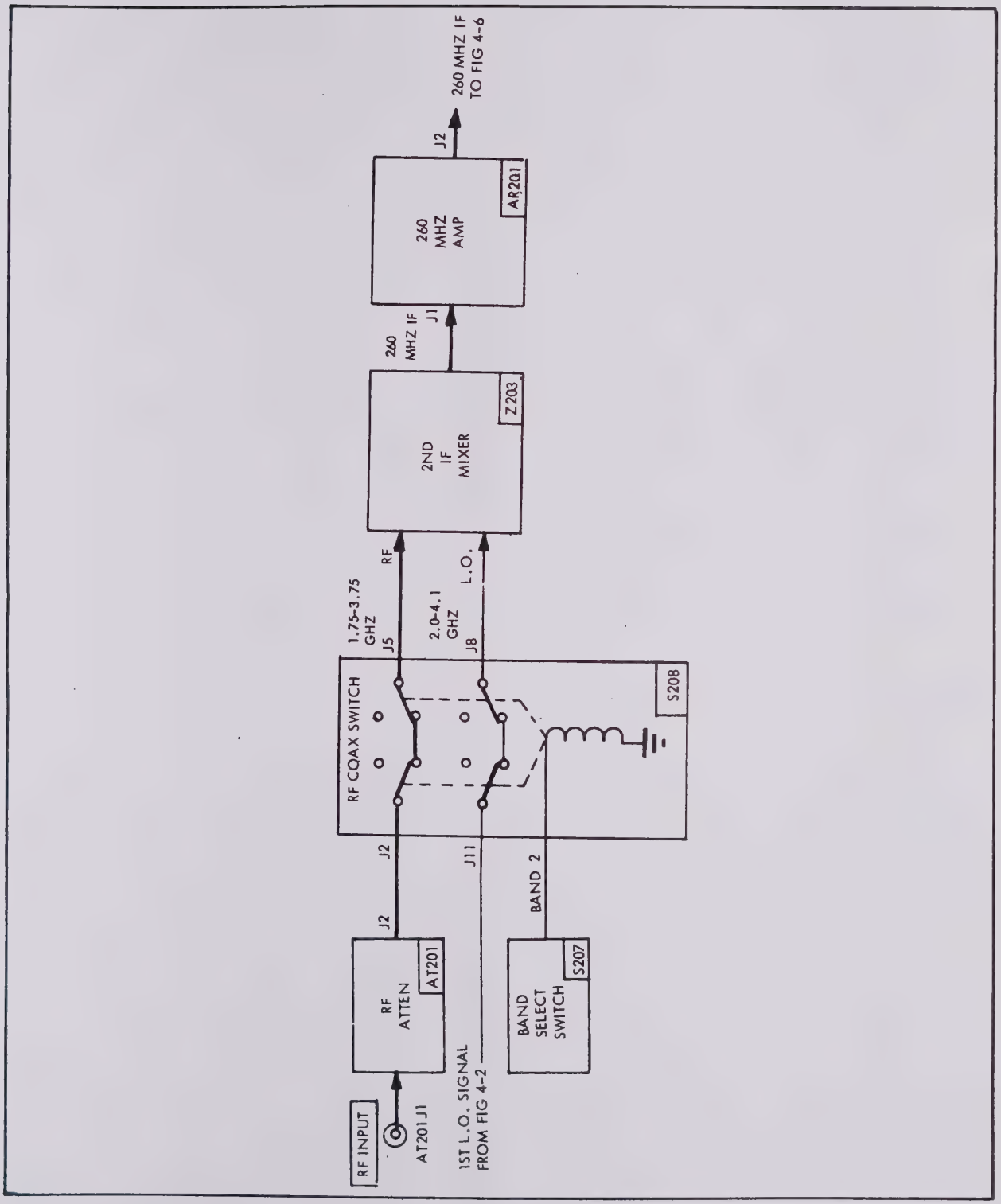
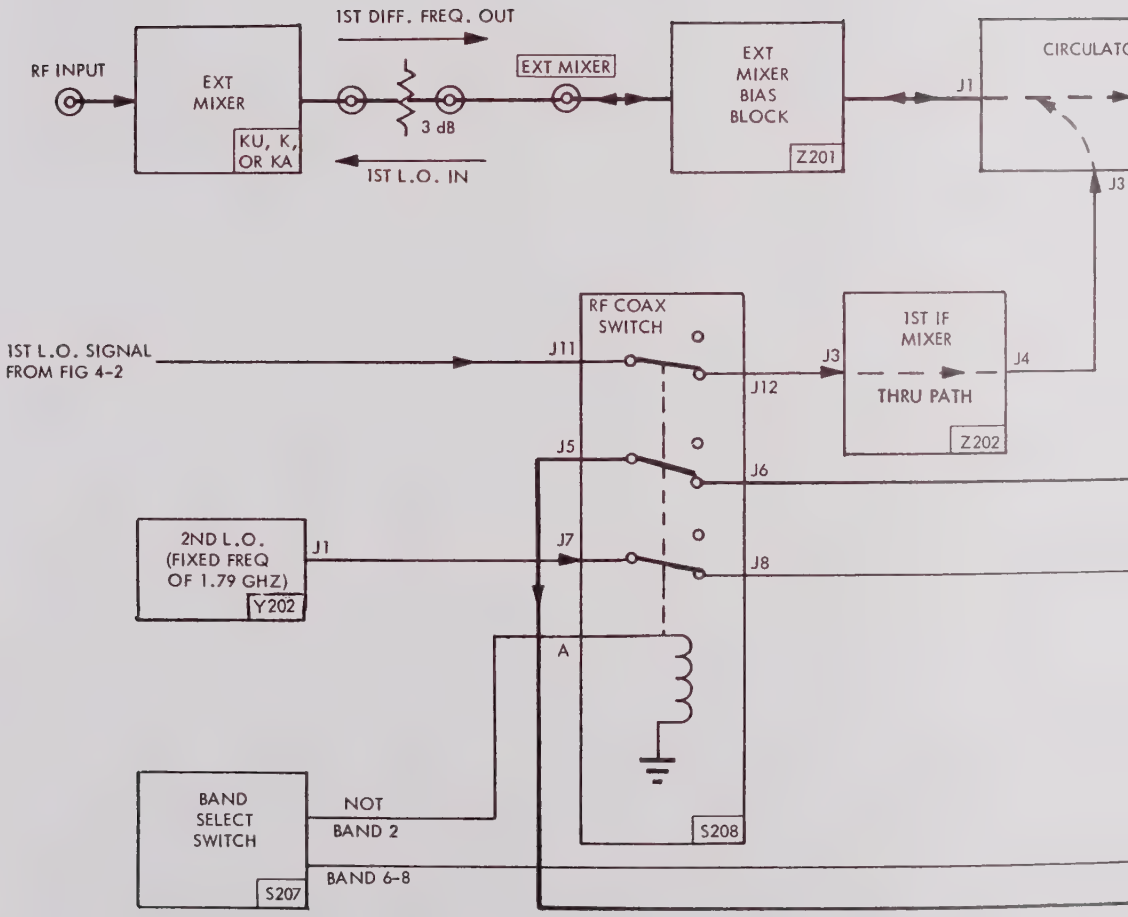


Figure 4-4. 1st & 2nd IF Circuit Configuration for Band 2


1ST DIFF. FREQ. OUT
RF INPUT
EXT MIXER
KU, K, OR KA
3 dB
EXT MIXER
1ST L.O. IN
EXT MIXER BIAS BLOCK
Z201
J1
CIRCULATO
J3
1ST L.O. SIGNAL FROM FIG 4-2
J11
RF COAX SWITCH
J12
J3
1ST IF MIXER
THRU PATH
Z202
J4
J5
J6
2ND L.O. (FIXED FREQ OF 1.79 GHZ)
Y202
J1
J7
J8
A
BAND SELECT SWITCH
S207
NOT BAND 2
BAND 6-8
S208

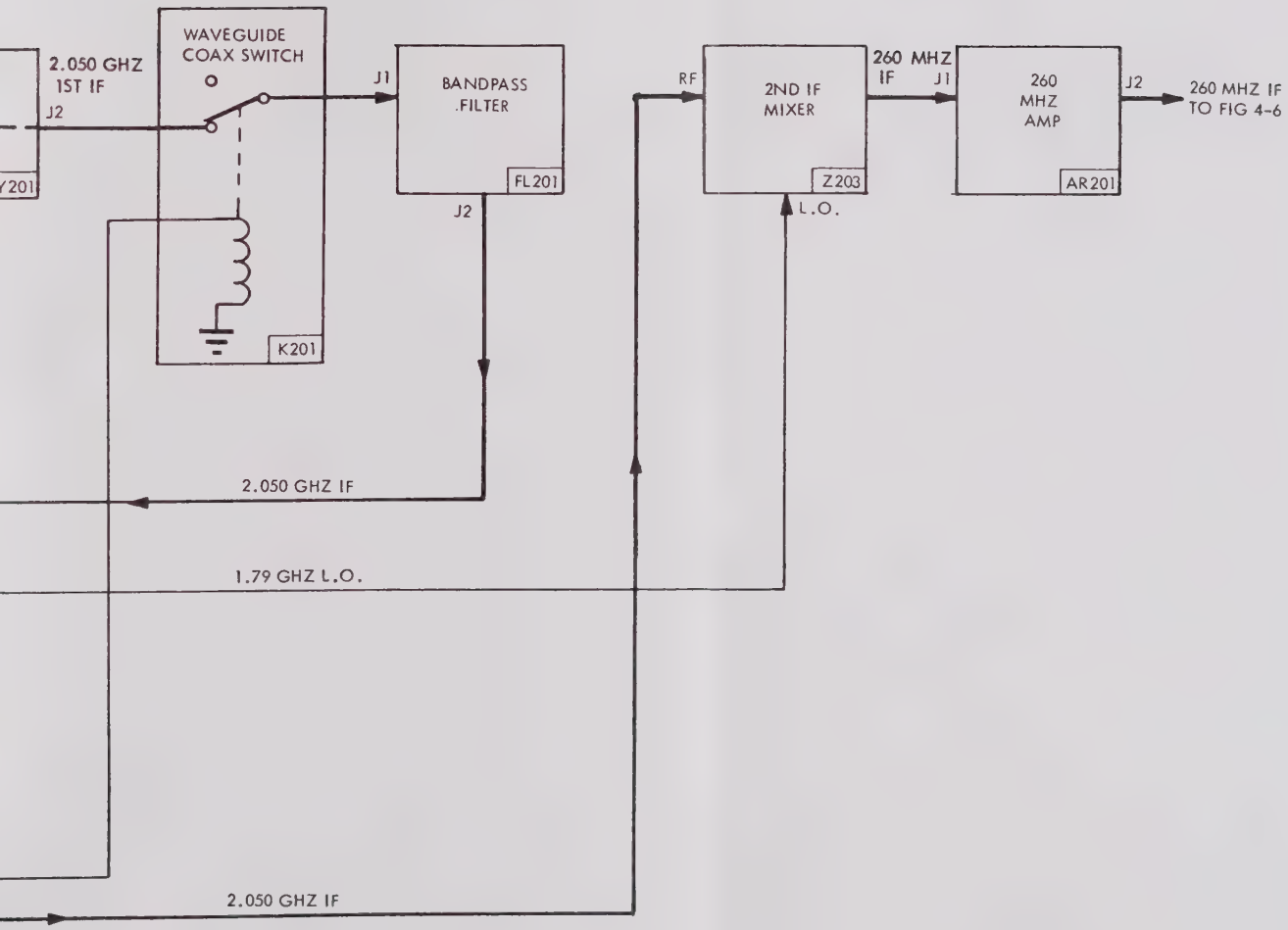


Figure 4-5. 1st & 2nd IF Circuit Configuration for Bands 6-8

4-2.3.1 3RD LOCAL OSCILLATOR

The 3rd local oscillator, located on board A201, is a voltage controlled oscillator (VCO) having a nominal center frequency of 202 MHz. Fine adjustment of the center frequency is accomplished by the FINE TUNE control (A20R1). In the wide-span mode, the 3rd local oscillator frequency is fixed at the frequency established by the FINE TUNE control. In the narrow-span mode, the 3rd local oscillator executes narrow-span sweeps (197 MHz to 207 MHz) under the control of the narrow-span sweep signal. These narrow-span sweeps are centered around the center frequency established by the FINE TUNE control. In the full span/signal identification mode, when the FULL SPAN-OFF-SIG IDENT switch is set to SIG IDENT, the following actions occur:

> For bands 1 through 4, the 3rd local oscillator output is reduced by 2 MHz on alternate sweeps. For bands 5 through 8, the image decoder logic on board A211 causes the frequency to be increased by 2 MHz. The difference between bands 1 through 4 and bands 5 through 8 is caused by the fact that, for bands 5 through 8, the selected harmonic of the 1st local oscillator frequency is below the frequency of the RF input, whereas for bands 1 through 4, the selected harmonic of the 1st local oscillator frequency is above the RF input frequency.

4-2.3.2 3RD IF CIRCUITS

The 3rd IF mixer receives the 260 MHz IF signal from the 1st and 2nd IF circuits, and also receives the output of the 3rd local oscillator. The resulting 60 MHz difference signal produced by the mixing action is applied through the diode switch and 6 dB attenuator (on board A201) to the 60 MHz amplifier-filter on board A202. The resulting 60 MHz IF output is applied to the 4th IF mixer.

In the full span/signal ident mode, when the FULL SPAN-SIG IDENT switch is set to SIG IDENT, the diode switch is activated by the SIG IDENT level from the 3rd local oscillator. When the diode switch is activated, the 60 MHz output of the 3rd IF mixer is attenuated by 6 dB on alternate sweeps. The attenuated output is ultimately used to produce the image signal on the CRT, permitting identification of the correct frequency band for the signal of interest.

The 60 MHz amplifier includes an automatic gain control (AGC) circuit on board A211. The level of the AGC signal depends upon the selected frequency band, and is varied to compensate for reductions in the conversion efficiency of the 1st IF mixer for the upper frequency bands.

4-2.3 4TH IF CIRCUITS

The 60 MHz IF output of the 3rd IF mixer is applied to the 4th IF mixer on board A202. The 60 MHz IF signal is mixed with the 53.5 MHz output of the 4th local oscillator, also on board A202. The resulting difference frequency output is amplified by the 6.5 MHz amplifier, producing the 6.5 MHz IF signal. The CAL adjustment adjusts the level of the 6.5 MHz output for amplitude calibration purposes. The 6.5 MHz IF signal is then applied through an IF attenuator (AT202) to the video circuits. The IF attenuator, controlled by front panel switches, permits up to 41 dB of attenuation to be applied to the IF signal.

4-2.4 VIDEO CIRCUITS (figure 4-7)

When RESOLUTION BW KHz switch A210S1 is in any position except AUTO, switch A210S1 selects the IF bandwidth (1000 KHz, 100 KHz, 10 KHz, 1 KHz, .3 KHz or .1 KHz) of the 4th IF (6.5 MHz) signal. When switch A210S1 is in the AUTO position, the position of the FREQ SPAN/DIV switch selects the bandwidth, assuring that the optimum IF bandwidth is selected in automatic operation. The bandwidth selection commands control the 100 MHz filter (A203), the 6.5 MHz crystal filters (A208 and A204), and the video filter (A206).

The 100 KHz filter and the 6.5 MHz crystal filters operate together to select the resolution bandwidth of the 6.5 MHz 4th IF signal. Diode switches bypass all filter elements when the 1000 KHz bandwidth is selected. When the 100 KHz bandwidth is selected, diode switches also bypass the filter elements in the 6.5 MHz crystal filters. The 100 KHz filter performs bandpass filtering when the selected bandwidth is 100 KHz or less, and the 6.5 MHz crystal filters perform additional filtering when the selected bandwidth is less than 100 KHz. No filtering is required for the 1000 KHz bandwidth. The IF ATTENUATOR VARIABLE control (R215) permits the gain of the output amplifier for the 100 KHz bandpass filter to be reduced by up to 10 dB.

The amplified and filtered output of the second 6.5 MHz crystal filter is applied to the LIN-LOG amplifier (A205). After four stages of input amplification, a diode switch routes the 6.5 MHz signal to either the linear or the logarithmic amplifier-detector, as determined by the setting of DISPLAY LAW switch S204. The detected video output of the selected amplifier-detector is supplied through an output amplifier to the video processor.

The video processor (part of A206) performs the following functions:

a. When the resolution bandwidth is 10 KHz, 1 KHz, .3 KHz, or .1 KHz, or when VIDEO PROCESSOR switch S205 is set to 10 KHz, a transistor switch conducts to place a 10 KHz low-pass filter in the video path to the output amplifier. The low-pass filter accomplishes smoothing (noise averaging) of the video.

b. When the VIDEO PROCESSOR switch is set to 100 Hz, a transistor switch conducts to place a 100 Hz low-pass filter in the video path, to the output amplifier. The low-pass filter accomplishes smoothing (noise averaging) of the video.

c. When the VIDEO PROCESSOR switch is set to PULSE, relay A206K1 energizes, and a transistor switch conducts. These actions place a peak detector in the video path to the output amplifier to enhance the display of pulses.

d. When the DISPLAY LAW switch is set to 2 dB/Div, the 2 dB/Div transistor switch is cut off, removing the ground path (through a resistor) for the summing junction of the output amplifier. A positive voltage is applied to the baseline clamp, and a negative offset voltage is applied (via the 2 dB offset potentiometer and the offset circuit) to the summing junction. These actions cause the logarithmic scaling of the display to be changed to 2 dB division.

4-2.5 100 MHZ CALIBRATOR A207 (figure 4-8)

Crystal-controlled oscillator Y1/Q1 generates a 100 MHz output, which is coupled through transformer T1 to 100 MHz limiter Q4/Q5, and to amplifier A1. 100 MHz Amp Set control R19 sets the 100 MHz output level from limiter Q4/Q5. The output of amplifier Q1 is supplied through matching transformer T2 to step recovery diode CR2, which functions as a multiplier to generate the 100 MHz harmonics supplied through the transmission line to the resistor attenuators. The output of the 100 MHz limiter is the amplitude-calibrated 100 MHz fundamental frequency, which is combined in the resistor attenuators with the harmonics from the transmission line. The resulting comb output is made available at the front panel connector.

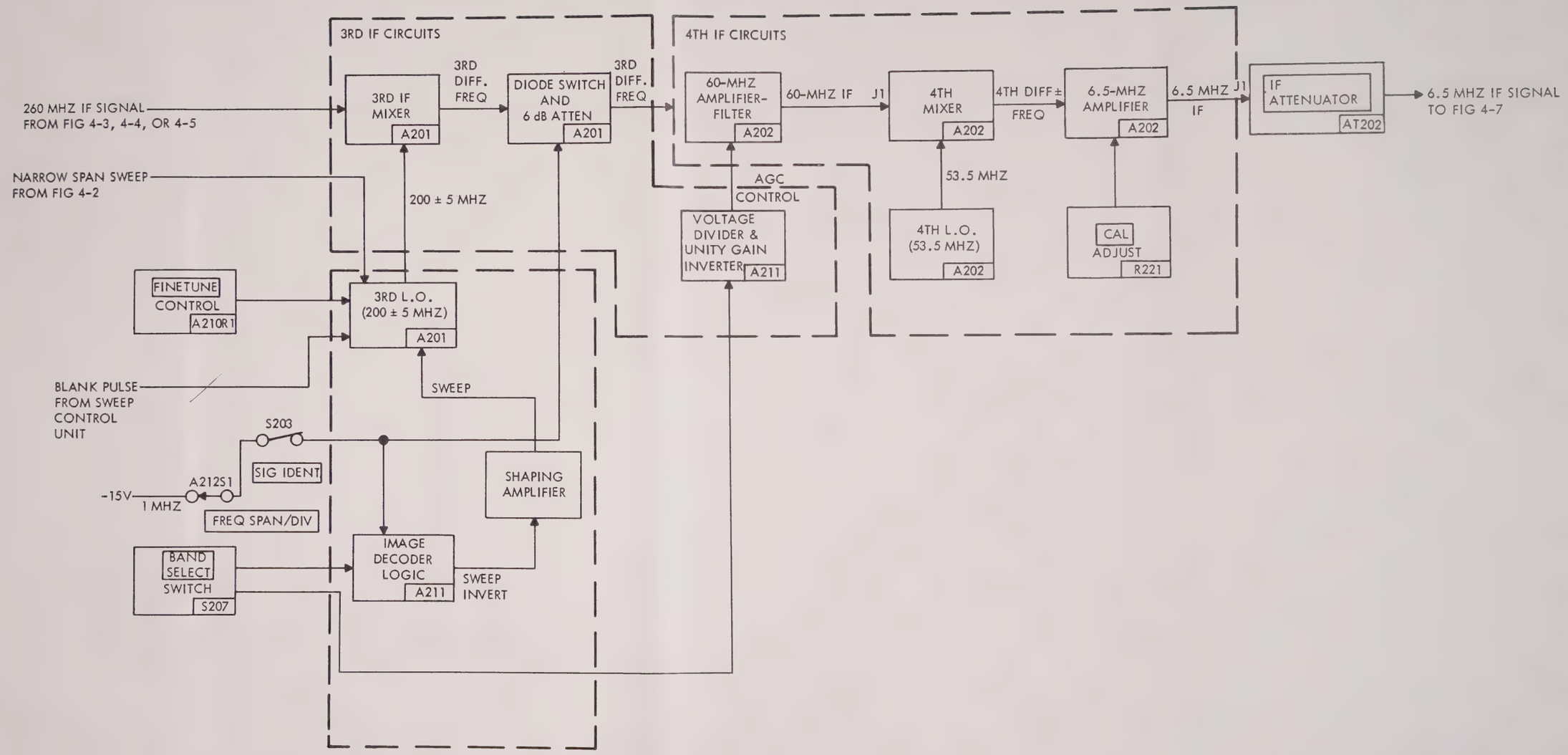


Figure 4-6. 3rd & 4th IF Circuits

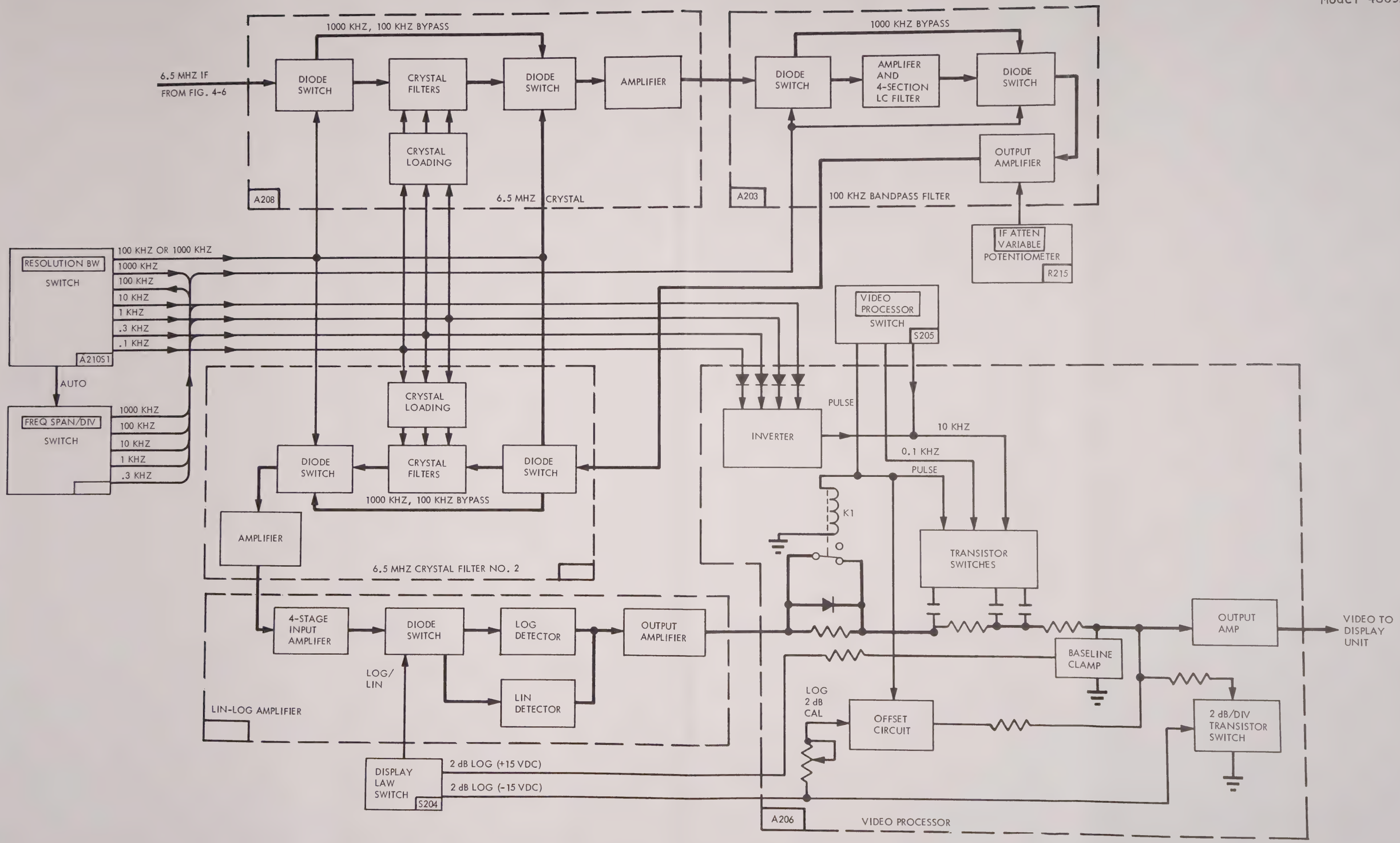


Figure 4-7. Video Circuits

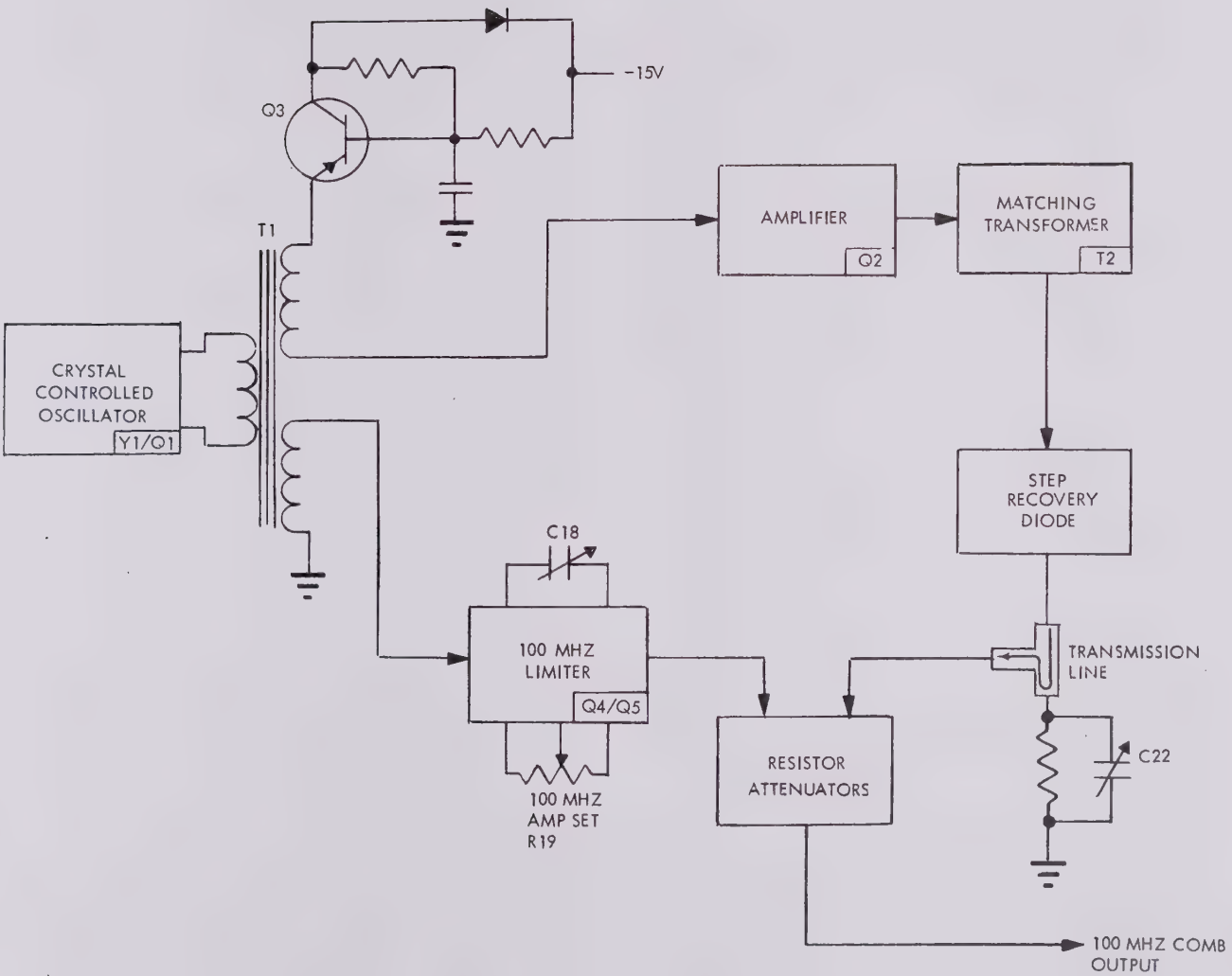


Figure 4-8. 100 MHz Calibrator

SECTION V

MAINTENANCE

5-1. GENERAL

Maintenance of the Model 4809A includes performance testing, calibration, troubleshooting, and repair. Performance tests (Section VI) and calibrations (Section VII) are normally conducted periodically to assure that the instrument is operating properly, and to verify that calibrations are within limits.

In general, faults can be divided into two categories. Degradation faults are indicated by a gradual deterioration in equipment performance. Degradation faults are detected by making periodic performance checks and comparing results with previously-recorded values. Faults of this type may ordinarily be corrected by recalibration, but frequent necessity for recalibration, or inability to achieve calibration, is an indication of a marginal or defective component which should be isolated and replaced. The other category of faults consists of component failures, resulting in an obvious failure of the spectrum analyzer, such as loss of display, loss of frequency span, or loss of signal between the input and the display.

For degradation faults, an analysis of the specific performance test results or calibration procedure observations which show abnormalities will usually permit localization of the trouble. For component failures, it is usually necessary first to isolate the trouble to the display section or tuning unit section. Final trouble isolation is then accomplished by signal checks in the malfunctioning unit.

5-1.1 LOCATION OF COMPONENTS AND ADJUSTMENTS

The interior views presented in figure 5-1 are marked to identify major assemblies and component assemblies. Each internal adjustment control is designated. These views are useful for repair operations, and also for performing the calibration of Section VII.

5-2. OVERALL CHECKOUT AND TROUBLESHOOTING (figure 5-2)

The performance checks in Section VI provide the principal means for checking out the Model 4809A. Figure 5-2 provides detailed checkout, and troubleshooting of faults in the replaceable module.

In using figure 5-2, the following general procedure applies:

1. Analyze the symptoms of malfunction to determine whether or not the sweep control unit and the display unit can be eliminated as the cause. If the sweep control unit and the display unit cannot be eliminated, perform the performance tests for these units provided in the applicable technical manuals.

2. If the display unit and sweep control unit are determined to be operating normally, the fault is in the Model 4809A tuning unit. Before proceeding to figure 5-2, perform the following steps:

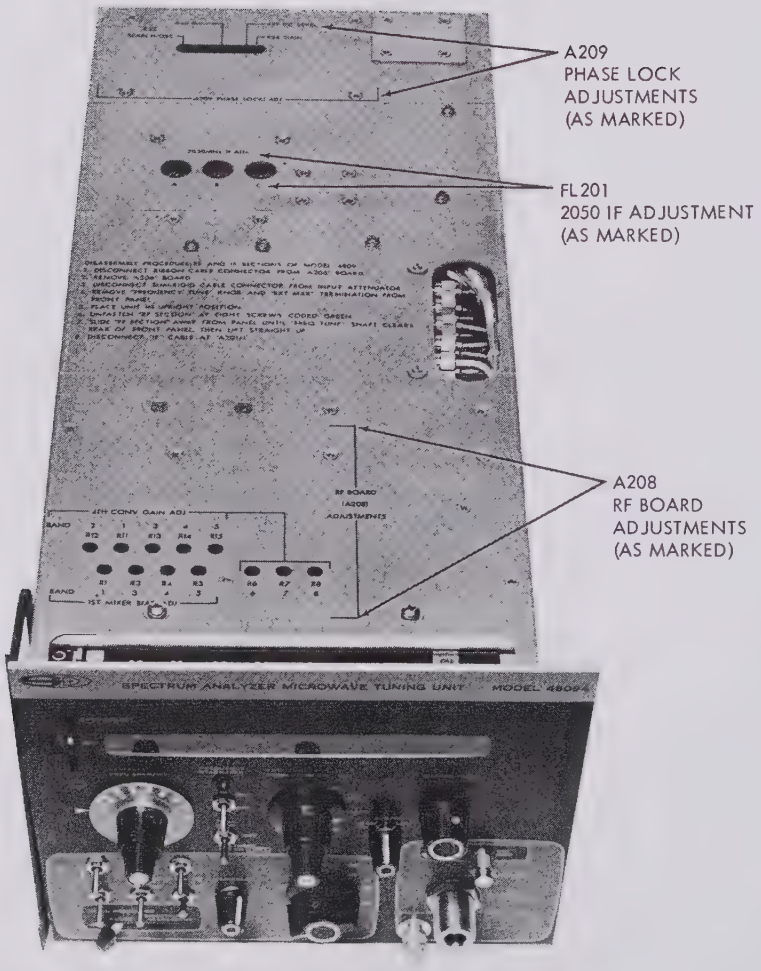
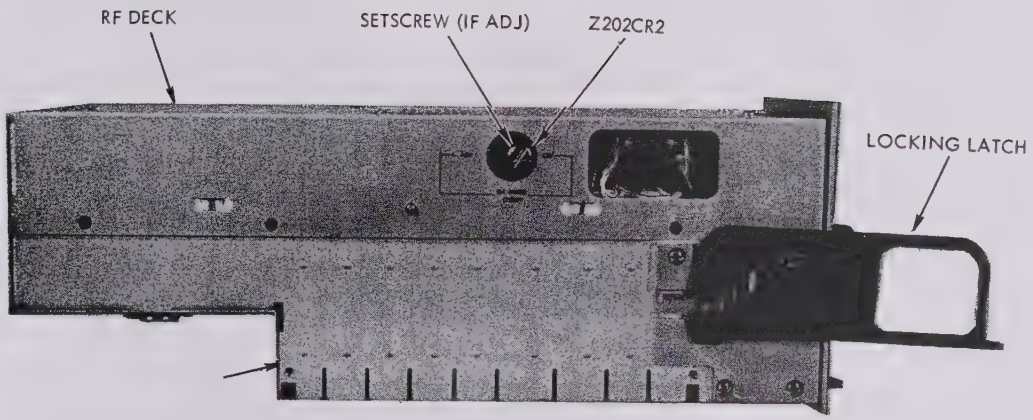


Figure 5-1. Components and Adjustments Location
(Sheet 1 of 6)



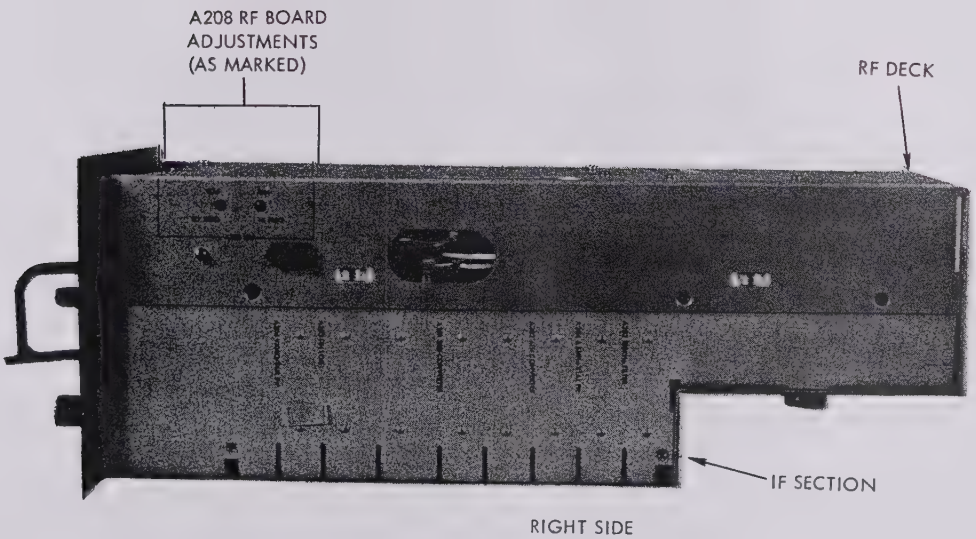


Figure 5-1. Components and Adjustments Location
(Sheet 2 of 6)

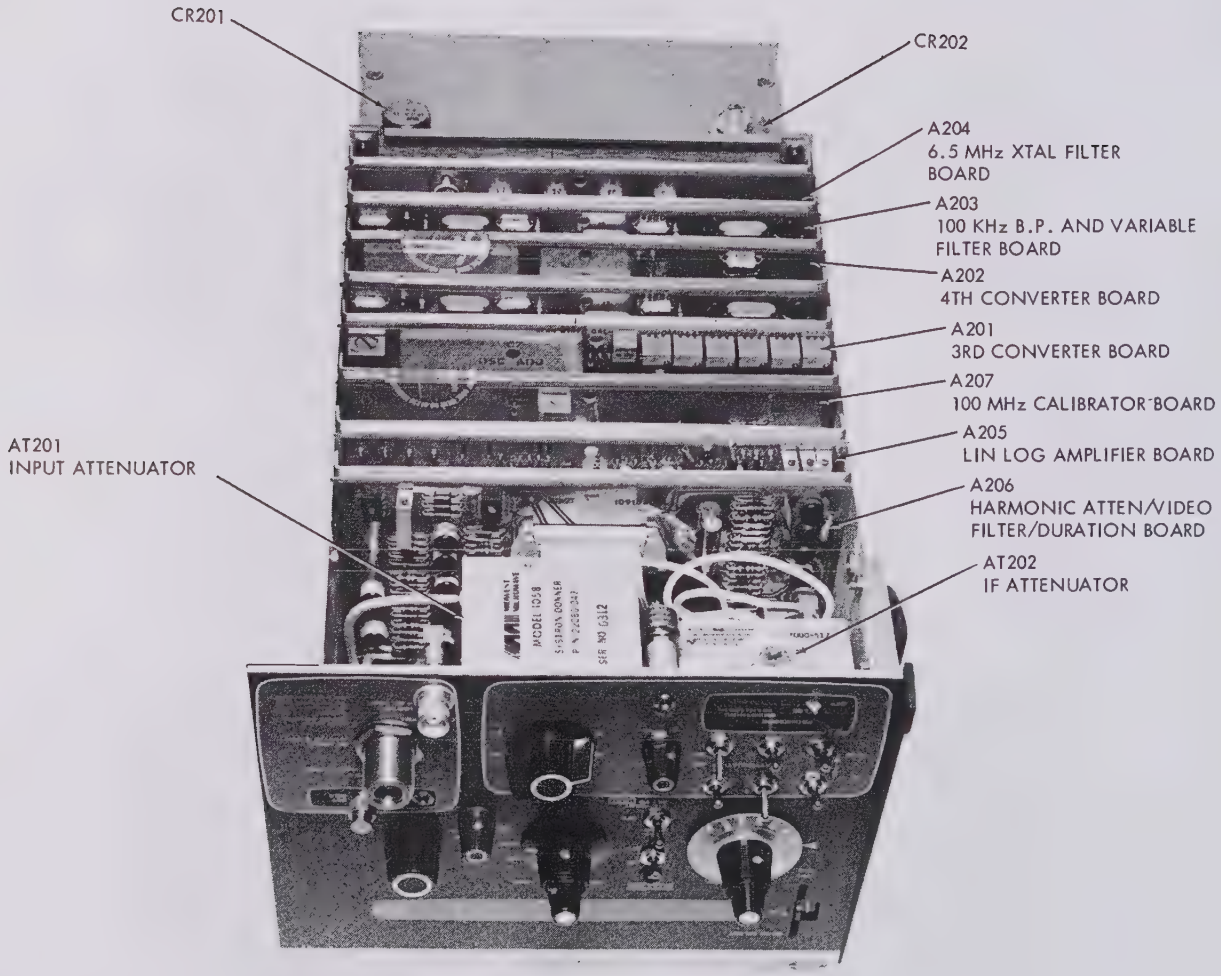
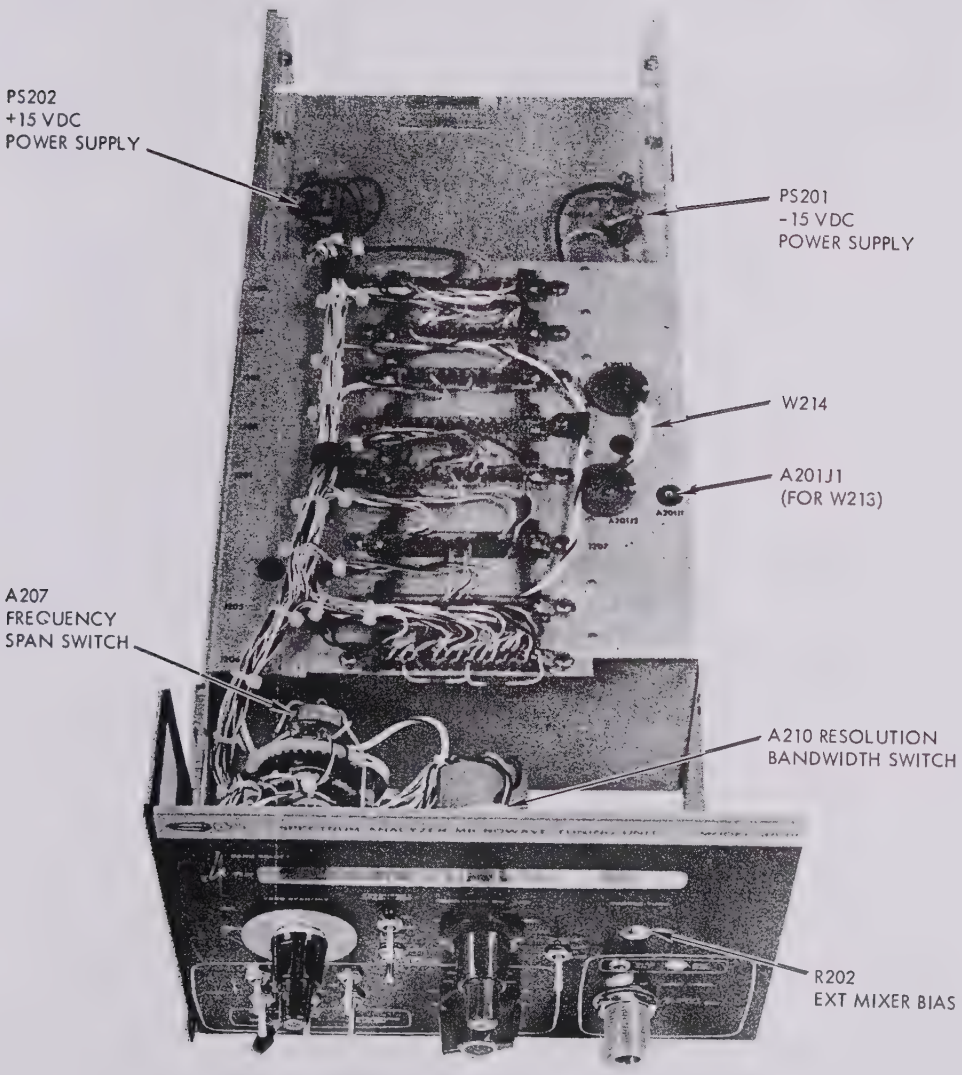
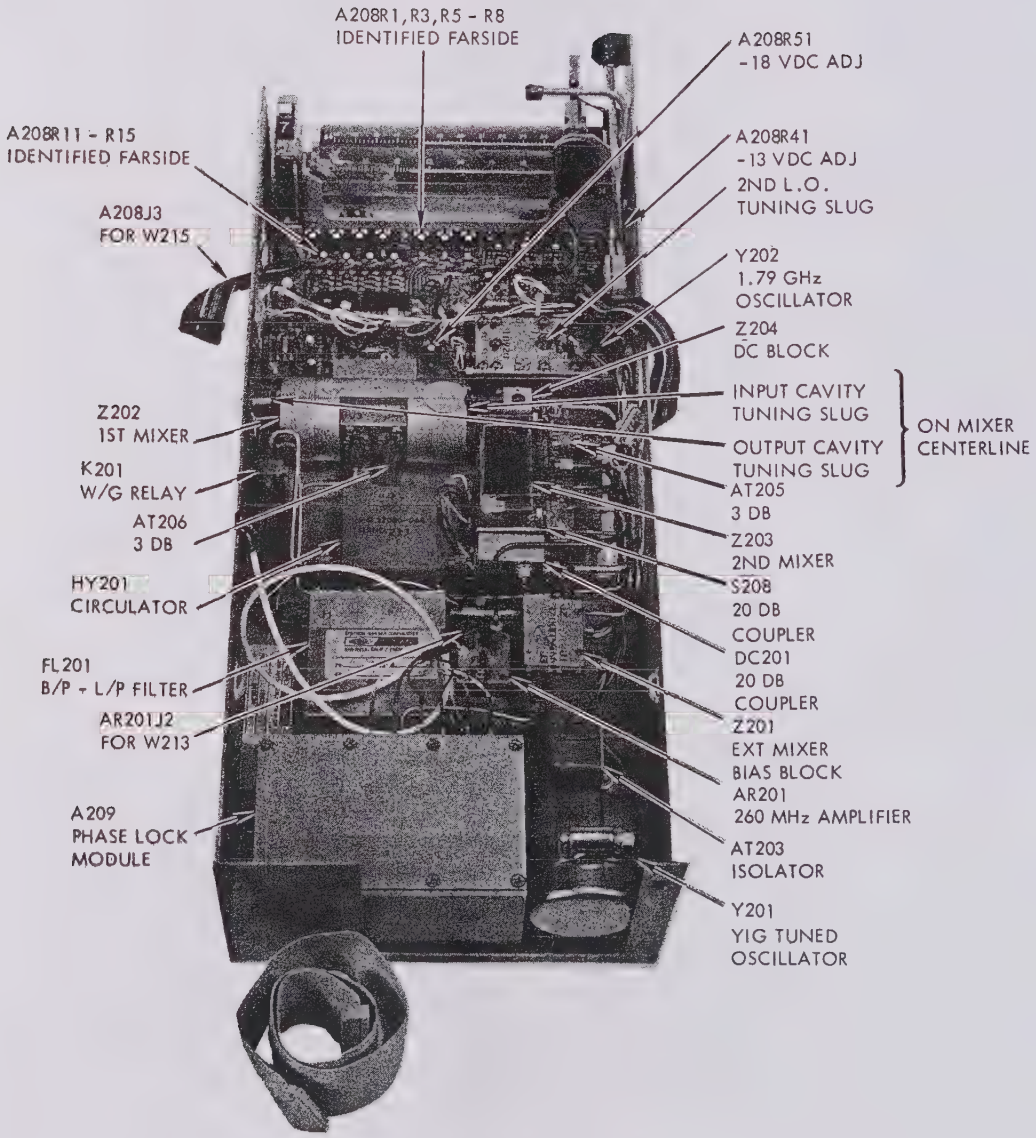


Figure 5-1. Components and Adjustments Location
(Sheet 3 of 6)



TOP VIEW
IF SECTION AND FRONT PANEL ASSEMBLY

Figure 5-1. Components and Adjustments Location
(Sheet 4 of 6)



RF DECK BOTTOM VIEW

Figure 5-1. Components and Adjustments Location
(Sheet 5 of 6)

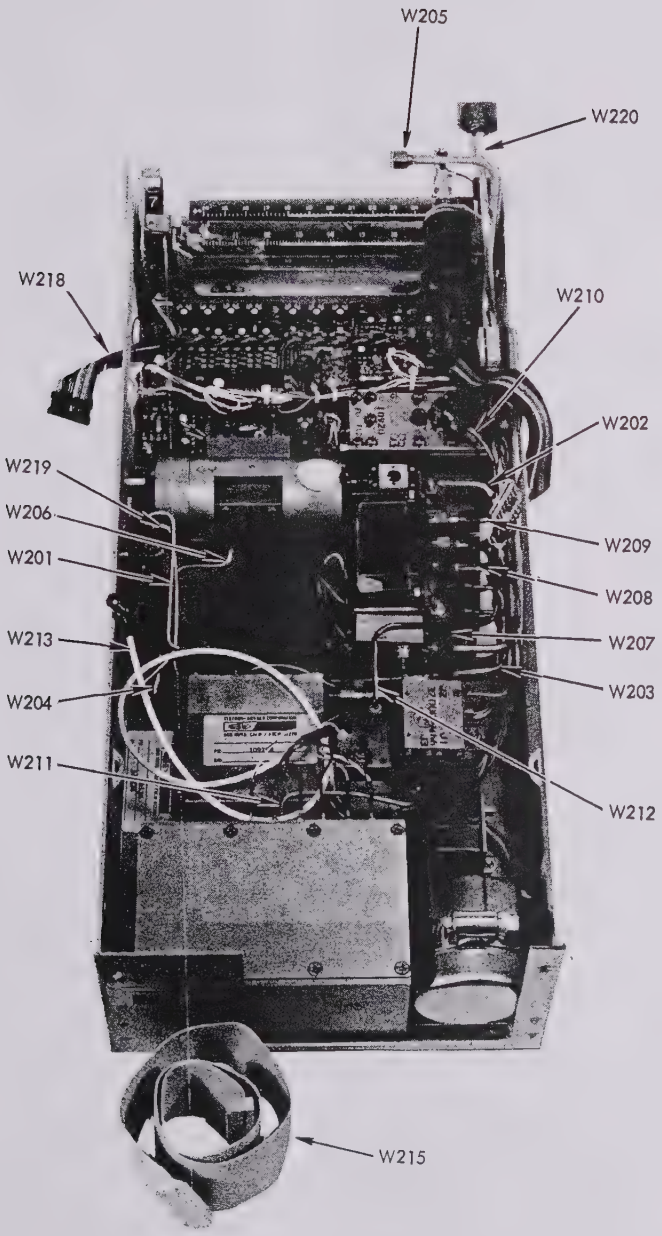


Figure 5-1. Components and Adjustments Location
(Sheet 6 of 6)

a. Check ±15-volt outputs of the 15-volt power supplies (PS201) and PS202) in the tuning unit. If either voltage (14.5V - 15.5V) is abnormal, replace the associated power supply.

b. Measure voltages from pin A to pin B, and from pin C to pin B, of coax switch S208 with the BAND SELECT switch set to each band position. For bands 1, 3, 4, 5, 6, 7, and 8, +24 volts should be present between pins A and B, and 0 volts should be present between pins C and B. For band 2, +24 volts should be present between pins C and B, and 0 volts should be present between pins A and B. If voltages are abnormal, replace A211. If voltages (24V Supply = 21V - 30V) are still abnormal, BAND SELECT switch S207 is defective.

c. Check operation of the tuning unit in each band to determine whether all bands are abnormal, or if only certain bands have abnormally low sensitivity.

d. Check whether operation is abnormal for all settings of FREQ SPAN/DIV, RESOLUTION BW, IF ATTENUATION, DISPLAY LAW LIN/LOG, VIDEO PROCESSOR, FULL SPAN-OFF-SIG IDENT, and INPUT ATTEN switches.

If replacement of the module indicated to be defective in figure 5-2 fails to correct the malfunction, check the cables to the module that is indicated to be defective. The checks in figure 5-2 are as follows:

a. START Sequence. This sequence is used to isolate malfunctions that occur only on certain bands.

b. Sequence A. If all bands are abnormal, this sequence is used to determine whether the fault is present in all operating modes and switch positions. If the fault is present in all operating modes and switch positions, the 1st local oscillator output is checked to determine whether or not the fault is in the 1st local oscillator circuits.

c. Sequence B. This sequence is used to isolate faults in the 1st local oscillator circuits.

d. Sequence C. When the 1st local oscillator output is normal, the sequence is used to determine whether the fault is in the RF deck or in the IF and video circuits. If the fault is in the RF deck, detailed troubleshooting isolates the defective module.

e. Sequence D. This sequence is used to isolate faults in the IF and video circuits.

f. Sequence E. This sequence is used to isolate faults that occur only in certain modes, or in certain positions of the FREQ SPAN/DIV, RESOLUTION BW, INPUT ATTEN, IF ATTENUATION and VIDEO PROCESSOR switches.

NOTE

Measurement of average noise level with a signal injected at various points in the tuning unit is used extensively in figure 5-2 to isolate malfunctions. Refer to paragraph 5-3 for the general procedure for measuring average noise level.

5-3. GENERAL PROCEDURE FOR MEASURING AVERAGE NOISE LEVEL

Measurement of average noise level is one of the principal techniques for fault isolation in the tuning unit. To perform this test, the RF/IF signal path at some point in the tuning unit is interrupted, and a signal generator is connected to the point where the path was interrupted. The frequency of the signal generator output depends upon the point of connection, and corresponds to the frequency normally present at that point. The signal generator output level is then adjusted until the resulting level on the CRT is 20 dB above the average noise level present when the signal generator output is zero. The adjusted signal generator output level is then recorded from the output level meter of the signal generator. The average noise level in dBm is then obtained by subtracting 20 dB from the signal generator level previously recorded. The procedure is as follows:

1. Make the following preliminary control settings:

NOTE

Set up the sweep control unit for a 10 msec/division free-running sweep, and set baseline blanking to off.

Control	Setting
INPUT ATTEN	0
RESOLUTION BW - KHz	100
FREQ SPAN/DIV	100 KHz
DISPLAY LAW	10 dB/DIV
FREQUENCY STABILIZED	OFF
FULL SPAN-SIG IDENT	OFF
VIDEO PROCESSOR	100 Hz
IF ATTENUATION dB	None (all switches down)
IF ATTENUATION VARIABLE	0

2. Connect the signal generator to the point of test, and set up the signal generator for the frequency which corresponds to the intermediate frequency normally present at the point of test.

3. With zero signal output from the signal generator, observe the CRT display, and note the level (in dB) which corresponds to the average noise level.

4. Adjust the signal generator output level until the horizontal line produced on the CRT display by the signal generator output is exactly 20 dB above the average noise level noted in step 3.

5. Read and record the signal generator output level, as indicated on the output level meter of the signal generator.

6. Subtract 20 dB from the output level recorded in step 5 to obtain the average noise level. For example, if the output level recorded in step 5 is -95 dBm, the average noise level is -95 dBm - 20 dB = -115 dBm.

5-4. DETAILED TROUBLESHOOTING OF REPLACEABLE MODULES

After locating the defective module using the procedures in figure 5-2, the malfunctioning module is normally removed and replaced. In some cases, it may be necessary to isolate, remove, and replace the defective part on printed circuit boards. The following data is provided to aid in isolating faults to the defective part on printed circuit boards:

1. The detailed circuit descriptions in Section IV, supported by detailed block diagrams.

2. The schematic diagrams in Section IX, with supporting voltage data and waveforms.

3. The calibration procedures for individual modules, provided in Section VII. These procedures can be used in the same manner as a test procedure for an individual circuit board.

The following modules are considered non-repairable at the field level:

Z201
Z202 (except for diode CR1 - see paragraph 5-5.1)
Z203
Z204
Y201
A211Y202
HY201
S208
K201
AT201
AT203
AT205
FL201
AR201
DC201
A209
PS201
PS202
3rd Local Oscillator & Mixer Board (Part of A201)
4th Local Oscillator & Mixer Board (Part of A202)

5-5. REPAIR AND REPLACEMENT

The schematic diagrams in Section IX include parts location information for each component assembly and circuit board assembly. Complete replacement parts information is given in the parts list, Section VIII.

If repair assistance is required, contact the factory:

Sales Manager, Microwave Division
Systron-Donner Corporation
14844 Oxnard Street
Van Nuys, California 91411
Telephone (213) 786-1760

Be sure to include the equipment model number and serial number in all communications.

5-5.1 REPLACEMENT OF FIRST MIXER DIODE

The input mixer diode is susceptible to damage from input signal overloads. Replace a damaged diode as follows:

1. Remove tuning unit from display unit.
2. Unscrew the diode cap, accessible through the left side panel opening (see figure 5-1).
3. Remove and replace diode (Z202CR1).
4. Install diode cap.

NOTE

It is advisable to conduct a performance check of the unit after replacing input mixer diode, followed by the indicated adjustments if required.

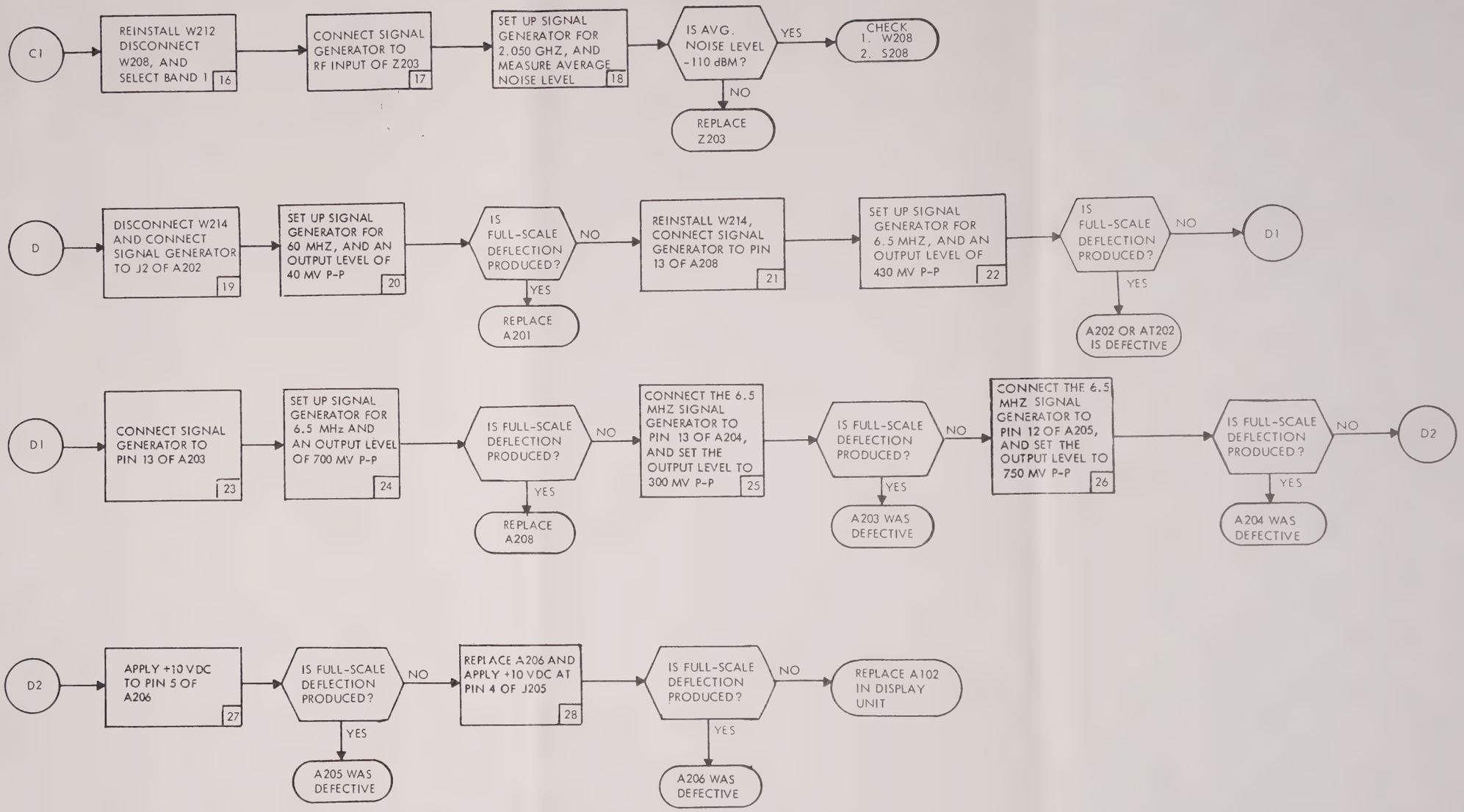


Figure 5-2. Troubleshooting Diagram (Sheet 3 of 4)

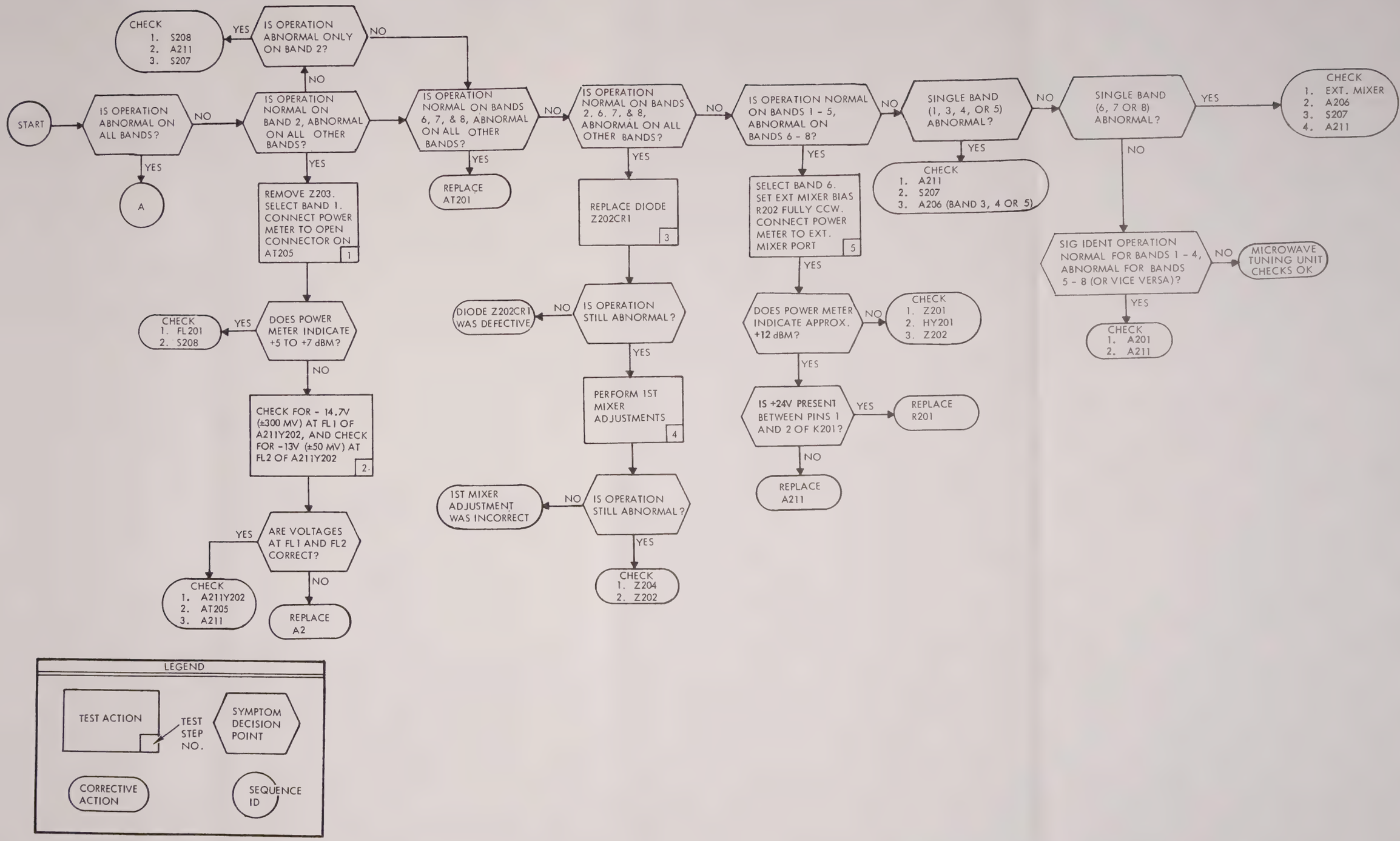

START
IS OPERATION ABNORMAL ON ALL BANDS?
YES
A
NO
IS OPERATION NORMAL ON BAND 2, ABNORMAL ON ALL OTHER BANDS?
YES
REMOVE Z203. SELECT BAND 1. CONNECT POWER METER TO OPEN CONNECTOR ON AT205 1
DOES POWER METER INDICATE +5 TO +7 dBM?
YES
CHECK 1. FL201 2. S208
NO
CHECK FOR - 14.7V (±300 MV) AT FL1 OF A211Y202, AND CHECK FOR -13V (±50 MV) AT FL2 OF A211Y202 2.
ARE VOLTAGES AT FL1 AND FL2 CORRECT?
YES
CHECK 1. A211Y202 2. AT205 3. A211
NO
REPLACE A2
NO
IS OPERATION ABNORMAL ONLY ON BAND 2?
YES
CHECK 1. S208 2. A211 3. S207
NO
IS OPERATION NORMAL ON BANDS 6, 7, & 8, ABNORMAL ON ALL OTHER BANDS?
YES
REPLACE AT201
NO
IS OPERATION NORMAL ON BANDS 2, 6, 7, & 8, ABNORMAL ON ALL OTHER BANDS?
YES
REPLACE DIODE Z202CR1 3
IS OPERATION STILL ABNORMAL?
NO
DIODE Z202CR1 WAS DEFECTIVE
YES
PERFORM 1ST MIXER ADJUSTMENTS 4
IS OPERATION STILL ABNORMAL?
NO
1ST MIXER ADJUSTMENT WAS INCORRECT
YES
CHECK 1. Z204 2. Z202
NO
IS OPERATION NORMAL ON BANDS 1 - 5, ABNORMAL ON BANDS 6 - 8?
YES
SELECT BAND 6. SET EXT MIXER BIAS R202 FULLY CCW. CONNECT POWER METER TO EXT. MIXER PORT 5
DOES POWER METER INDICATE APPROX. +12 dBM?
NO
CHECK 1. Z201 2. HY201 3. Z202
YES
IS +24V PRESENT BETWEEN PINS 1 AND 2 OF K201?
YES
REPLACE R201
NO
REPLACE A211
NO
SINGLE BAND (1, 3, 4, OR 5) ABNORMAL?
YES
CHECK 1. A211 2. S207 3. A206 (BAND 3, 4 OR 5)
NO
SINGLE BAND (6, 7 OR 8) ABNORMAL?
YES
CHECK 1. EXT. MIXER 2. A206 3. S207 4. A211
NO
SIG IDENT OPERATION NORMAL FOR BANDS 1 - 4, ABNORMAL FOR BANDS 5 - 8 (OR VICE VERSA)?
NO
MICROWAVE TUNING UNIT CHECKS OK
YES
CHECK 1. A201 2. A211
LEGEND
TEST ACTION
TEST STEP NO.
SYMPTOM DECISION POINT
CORRECTIVE ACTION
SEQUENCE ID

Figure 5-2. Troubleshooting Diagram (Sheet 1 of 4)

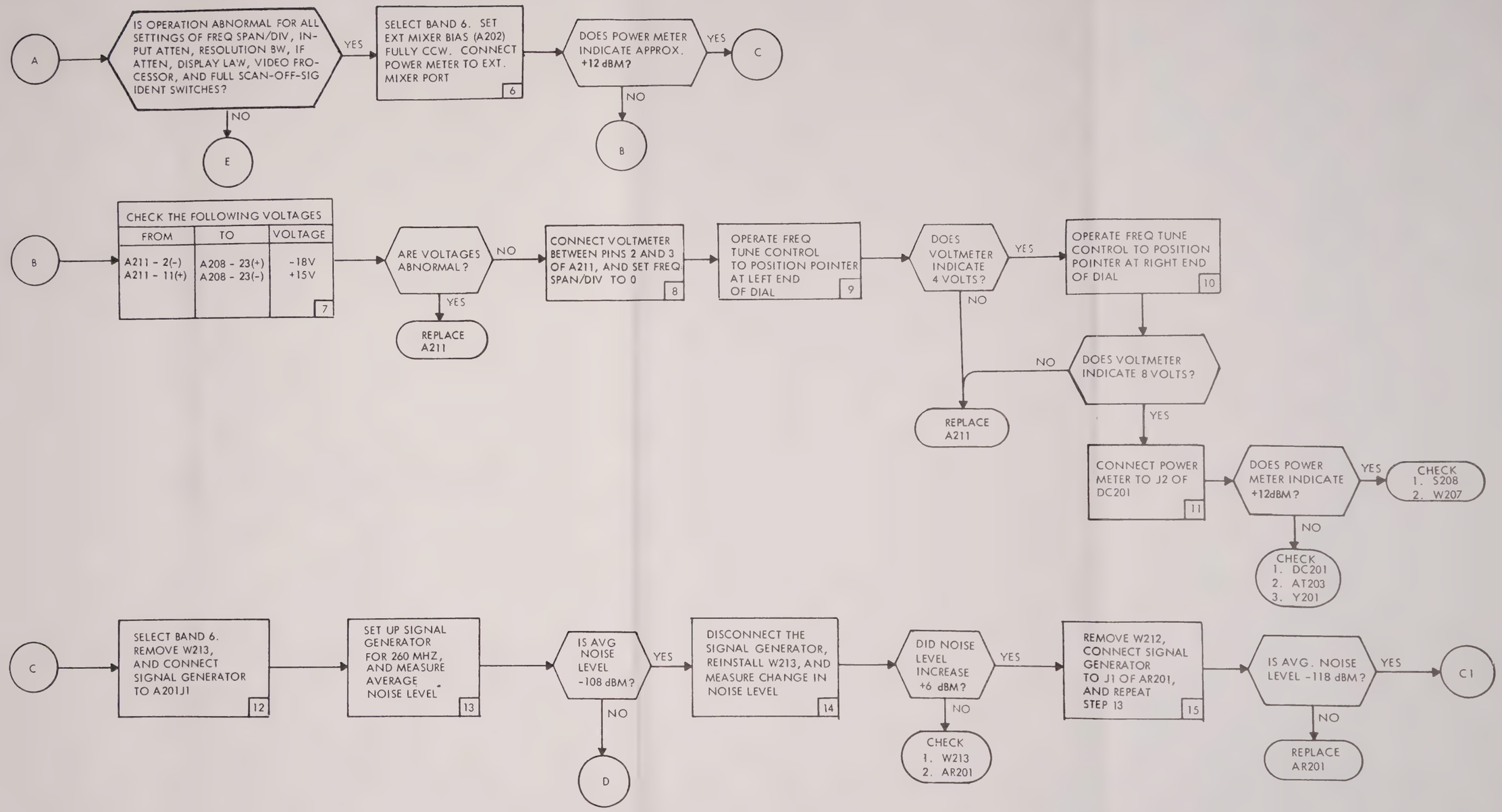


Figure 5-2. Troubleshooting Diagram (Sheet 2 of 4)

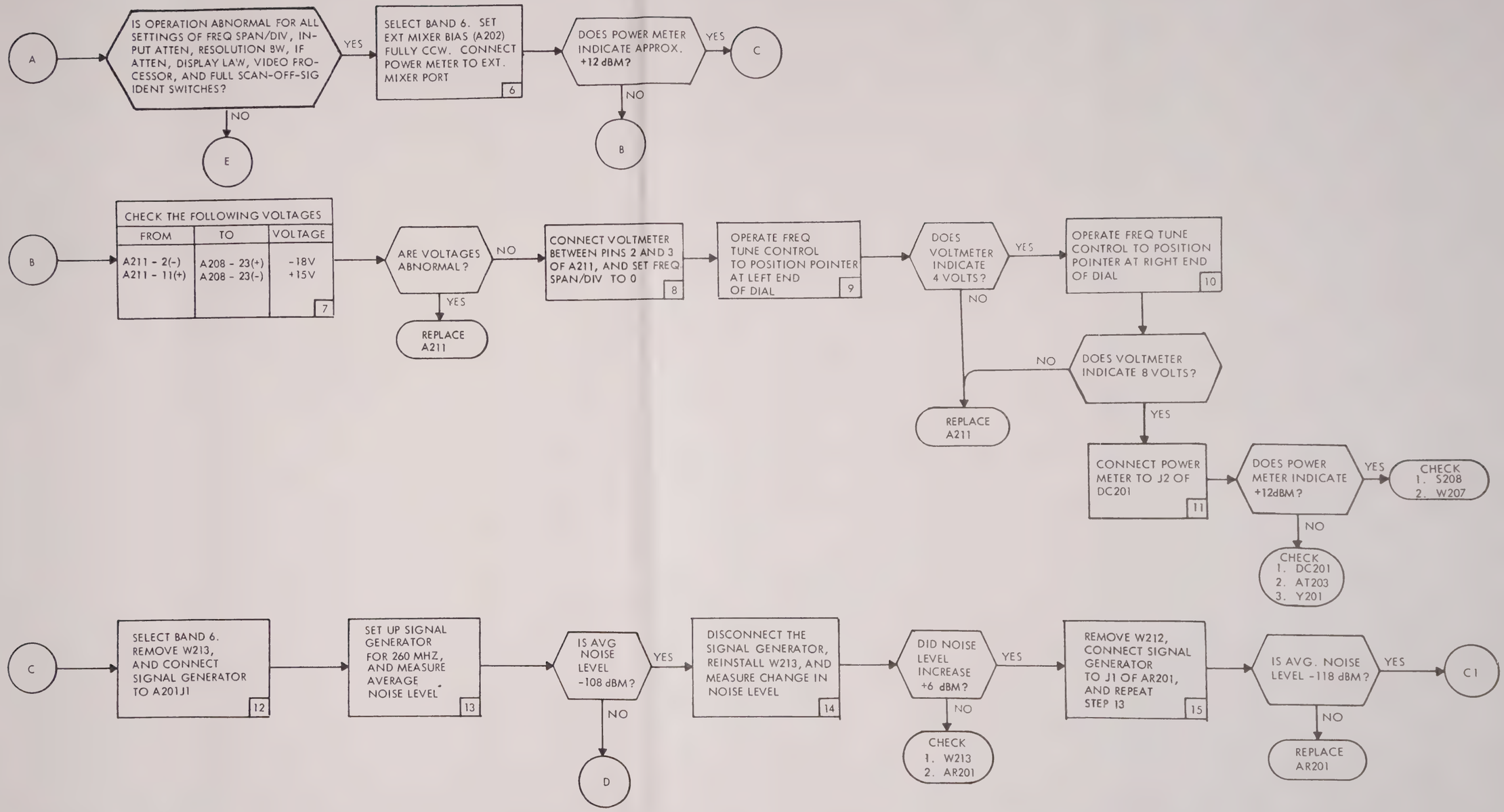


Figure 5-2. Troubleshooting Diagram (Sheet 2 of 4)

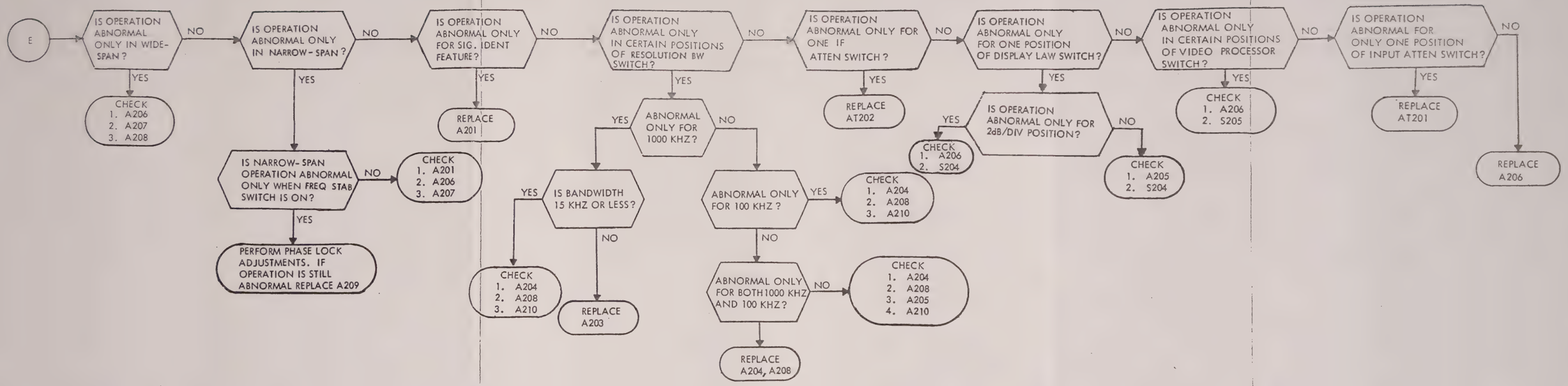


Figure 5-2. Troubleshooting Diagram (Sheet 4 of 4)

SECTION VI

PERFORMANCE CHECKS

6-1. INTRODUCTION

This section contains the Model 4809A performance check procedures listed in Table 6-1.

TABLE 6-1. PERFORMANCE CHECKS

PARAGRAPH NO.	TITLE
6-3	Functional Check
6-4	Residual Responses
6-5	Tuning Accuracy
6-6	Local Oscillator Stability
6-7	Noise Sidebands
6-8	Frequency Span Accuracy
6-9	IF Shape Factor
6-10	Amplitude Display Accuracy
6-11	Attenuator Accuracy
6-12	Sensitivity
6-13	Intermodulation Distortion
6-14	Frequency Response
6-15	Waveguide Mixer Checks
6-16	Reference Voltage Checks
6-17	Noise Level Check
6-18	First Local Oscillator Power and Response Check
6-19	2050 MHz IF Sensitivity Check

The performance checks in paragraphs 6-3 through 6-15 verify that the instrument meets the applicable performance specifications in Table 1-1. The performance checks in paragraphs 6-16 through 6-19 provide indications of the area of equipment manfunction. Performance Check Record Forms, containing blanks for entering actual

performance measurements are included as part of the procedures. Failure to meet performance specifications limits listed on the forms indicates a need for corrective action. Normally, the System Alignment procedure in Section VII should be attempted first.

6-2. EQUIPMENT REQUIRED

Items of test equipment required to conduct performance checks are listed in Table 6-2.

TABLE 6-2. PERFORMANCE CHECK TEST EQUIPMENT

ITEM		REQUIREMENTS	RECOMMENDED TYPE (or equivalent)
1	Comb Generator	1, 10, 100 MHz combs	HP 8406A
2	Low Pass Filter	1.8 GHz low-pass	K&L Microwave 5L380-1800-0
3	Calibrated Signal Generators	0.4 to 12.4 GHz	Various
4	Leveled Sweepers	0.01 - 40 GHz	Various
5	Power Meter		HP431C
6	Oscilloscope		HP1202A
7	Crystal Detector		HP420A

NOTE

Install 50-ohm termination (AT204) in EXT MXR connector when not operating in bands 6 to 8.

6-3. FUNCTIONAL CHECK

NOTE

Verify frequency and amplitude accuracy of 100 MHz calibrator before performing this test (see paragraph 7-4.2.7).

A. DESCRIPTION

Display is set up with no external signal. Then, with signal from 100 MHz calibrator, the presence of a full comb is verified, and display is optimized. Vertical gain and amplitude calibration are checked.

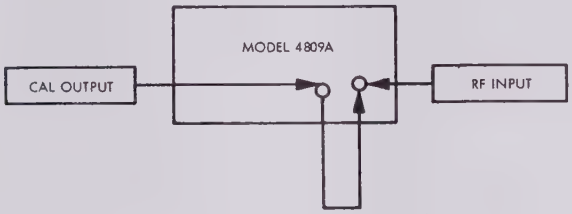
B. PRELIMINARY CONTROL SETTINGS

1. Sweep Speed (Sweep Control Unit): 3 msec/div free-running sweep with baseline blanking off.

2. Model 4809A Controls

Control	Setting	Control	Setting
BAND SELECT	1	INPUT ATTEN	10
FREQ SPAN/DIV	200 MHz/DIV	IF ATTENUATION	0
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)	IF ATTENUATION VARIABLE	0
FULL SPAN-SIG IDENT	OFF	DISPLAY LAW	10 dB/Div
RESOLUTION BW	10 KHz	VIDEO PROCESSOR	OFF
FREQUENCY STABILIZED	ON		

C. TEST SET-UP



D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Set up the display before making test set-up above by performing the Pre-Operational Set-UP Procedure in Section IV of Model 2311/2312 Operation and Service Manual.	None	None
2	Make test set-up shown above. Set FULL SPAN-SIG IDENT to FULL SPAN. Count the number of comb teeth on the display. If correct number of teeth is not displayed, attempt to obtain the correct number of teeth by centering the display with the horizontal calibration control on sweep control unit.	1% ±1 comb teeth	_____
3	Set FULL SPAN-SIG IDENT to OFF, set COARSE TUNE control to .100 GHz, and adjust FINE TUNE control to center the 100 MHz comb line. (The first comb line).	None	None
4	Set RESOLUTION BW to 100 KHz and FREQ SPAN/DIV to 100 KHz. Adjust focus control on display unit to obtain sharpest possible display.	Frequency stabilized light goes on	_____
5	Set up Sweep Control Unit for 10 msec/div free-running sweep. Set FREQ SPAN/DIV to 20 KHz, RESOLUTION BW to 10 KHz. Re-center 100 MHz comb line.	None	None

6-3. FUNCTIONAL CHECK (continued)

Step	Action	Spec Limit	Measurement
6	Set INPUT ATTEN to 10 dB, DISPLAY LAW to 2 dB/ DIV. Adjust CAL screwdriver adjustment on Model 4809A so that top of 100 MHz comb line just touches the LOG REF line on the graticule of the display.	Full-scale deflection	_____
7	Increase INPUT ATTEN to 20 dB, and adjust vertical calibration control on Sweep Control Unit so that amplitude of 100 MHz comb line on the display decreases 10 dB (five major divisions). Repeat steps 6 and 7 as required.	Amplitude decrease 10 dB for each 10 dB of input atten.	_____
8	Set DISPLAY LAW to 10 dB/DIV. INPUT ATTEN to 10 dB FREQ SPAN/DIV to 1 MHz, and operate FULL SPAN-SIG IDENT to SIG IDENT. A 6 dB-down image of the 100 MHz comb line shall appear 2 major divisions to the left of the 100 MHz comb line. Return FULL SPAN-SIG IDENT to OFF.	6-dB dowm image appears 2 ± divisions to the left.	_____
9	Turn IF ATTENUATION VARIABLE control to 10. The amplitude of the 100 MHz comb line shall decrease 10 dB. (one major division).	10 ± dB reduction in amplitude	_____
10	Set RESOLUTION BW to 1000 KHz and observe noise on baseline. Then, set VIDEO PROCESSOR switch to 10 KHz, and observe that noise on the baseline of the display is reduced.	Reduction in noise is observed.	_____
11	Set VIDEO PROCESSOR switch to 100 Hz, and observe that noise on the baseline of the display is reduced even further.	Additional reduction in noise is observed.	_____

6-4. RESIDUAL RESPONSES

A. DESCRIPTION

The instrument is swept through the full local oscillator range and checked for residual responses on bands 1 and 2 with full input attenuation.

B. PRELIMINARY CONTROL SETTINGS

1. Sweep Speed (Sweep Control Unit): 9 sec/division free-running sweep with baseline blanking off.

2. Model 4809A Controls

Control	Setting	Control	Setting
BAND SELECT	1	INPUT ATTEN	60
FREQ SPAN/DIV	200 MHz/DIV	IF ATTENUATION	0
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)	IF ATTENUATION VARIABLE	0
FULL SPAN-SIG IDENT	OFF	DISPLAY LAW	10 dB/DIV
RESOLUTION BW	10 KHz	VIDEO PROCESSOR	OFF
FREQUENCY STABILIZED	OFF	COARSE TUNE	1.0 GHz

C. TEST SET-UP – Terminate the RF INPUT connector with a 50-ohm termination.

D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Observe the display for residual responses on band 1.	None greater than -90 dBm	_____
2	Set BAND SELECT to 2. Observe the display for residual responses.	None greater than -90 dBm	_____

6-5. TUNING ACCURACY

NOTE

Verify frequency accuracy of 100 MHz calibrator before performing this test (see paragraph 7-4.2.7).

A. DESCRIPTION

The comb output of the 100 MHz calibrator is displayed on band 1. Deviations between the frequency dial reading and the graticule reading are noted.

B. PRELIMINARY CONTROL SETTINGS

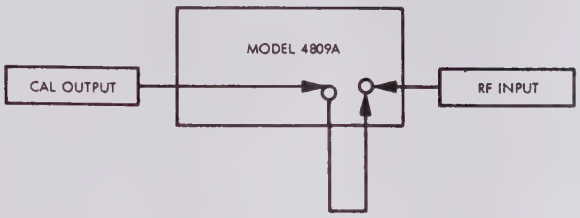
1. Sweep Speed (Sweep Control Unit): 10 msec/division free-running sweep.

2. Model 4809A Controls

Control	Setting	Control	Setting
BAND SELECT	1	INPUT ATTEN	0
FREQ SPAN/DIV	10 MHz	IF ATTENUATION	20
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)	IF ATTENUATION VARIABLE	0
FULL SPAN-SIG IDENT	OFF	DISPLAY LAW	10 dB/DIV
RESOLUTION BW	100 KHz	VIDEO PROCESSOR	OFF
FREQUENCY STABILIZED	OFF	FINE TUNE	centered

6-5. TUNING ACCURACY (continued)

C. TEST SET-UP



D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Make the test set-up. Adjust COARSE TUNE so that pointer is exactly at zero on dial. Momentarily set FULL SPAN-SIG IDENT to FULL SPAN and then back to OFF to eliminate hysteresis effects. Adjust FINE TUNE control to center the zero beat signal on the display.	Zero beat must fall at screen center ±5 MHz (±0.5 divisions) Maximum Deviation from screen center	_____
2	Set COARSE TUNE so that pointer is exactly at .100 GHz on dial. The 100 MHz comb line should appear at screen center.	±7 MHz (±0.7 divisions)	_____
3	Set COARSE TUNE so that pointer is exactly at 1.0 GHz. The 1.0 GHz comb line should appear at screen center.	±25 MHz (±2.5 divisions)	
4	Set COARSE TUNE so that pointer is exactly at 1.8 GHz. The 1.8 GHz comb line should appear at screen center.	±41 MHz (±4.1 divisions)	

6-6. LOCAL OSCILLATOR STABILITY

NOTE

Verify frequency accuracy of 100 MHz calibrator before performing this test (see paragraph 7-4.2.7).

A. DESCRIPTION

The comb output of the 100 MHz calibrator is displayed on band 2. The FM stability is measured by observing peak deviation between sweeps.

6-6. LOCAL OSCILLATOR STABILITY (continued)

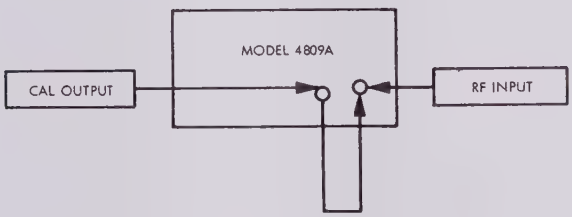
B. PRELIMINARY CONTROL SETTINGS

1. Sweep Speed (Sweep Control Unit): 3 msec/division free-running sweep.

2. Model 4809A Controls

Control	Setting	Control	Setting
BAND SELECT	2	INPUT ATTEN	set for full-scale
FREQ SPAN/DIV	500 KHz	IF ATTENUATION	deflection of 1.8
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)	IF ATTENUATION VARIABLE	GHz comb line
FULL SPAN-SIG IDENT	OFF	DISPLAY LAW	LIN
RESOLUTION BW	1 KHz	VIDEO PROCESSOR	100 Hz
FREQUENCY STABILIZED	ON	COARSE TUNE	1.8 GHz

C. TEST SET-UP



D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Adjust FINE TUNE control to center 1.8 GHz comb line, and adjust INPUT ATTEN and IF ATTENUATION to obtain full-scale deflection of 1.8 GHz comb line.	None	None
2	Set FREQ SPAN/DIV to 1 KHz, and again re-center 1.8 GHz comb line with FINE TUNE control.	None	None
3	Observe the frequency scale of the display for the maximum variation in the position of the 1.8 GHz comb line between sweeps.	Maximum Variation 150 Hz (0.15 division)	_____
4	Set FREQUENCY STABILIZED to OFF, RESOLUTION BW to 10 KHz, and FREQ SPAN/DIV to 100 KHz. Repeat step 3.	Maximum Variation 10 KHz (0.1 division)	_____

6-7. NOISE SIDEBANDS

A. DESCRIPTION

The average noise sidebands, 50 KHz away from a 400-MHz signal, are measured.

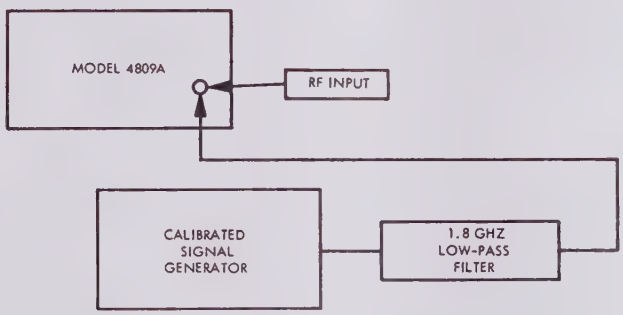
B. PRELIMINARY CONTROL SETTINGS

1. Sweep Speed (Sweep Control Unit): 100 msec/division free-running sweep.

2. Model 4809A Controls

Control	Setting	Control	Setting
BAND SELECT	1	INPUT ATTEN	10
FREQ SPAN/DIV	10 KHz	IF ATTENUATION	10
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)	IF ATTENUATION VARIABLE	10
FULL SPAN-SIG IDENT	OFF	DISPLAY LAW	10 dB/DIV
RESOLUTION BW	1 KHz	VIDEO PROCESSOR	100 Hz
FREQUENCY STAILIZED	ON	COARSE TUNE	.400 GHz

C. TEST SET-UP



D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Make the test set-up shown above. Set signal generator for 400 MHz, and adjust signal level for a full-scale display.	None	None
2	Center the signal on the screen using the FINE TUNE control. Measure the average noise level 5 divisions (50 KHz) to the left and right of the signal.	Noise level at least 70 dB down from 400 MHz signal	_____

6-8. FREQUENCY SPAN ACCURACY

A. DESCRIPTION

A comb generator is used to check each FREQ SPAN/DIV setting by comparing the number of comb teeth displayed with the required spanwidth.

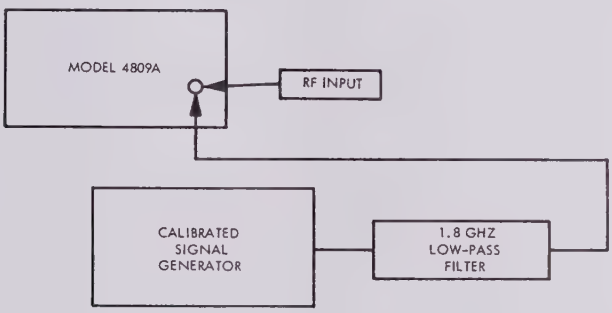
B. PRELIMINARY CONTROL SETTINGS

1. Sweep Speed (Sweep Control Unit): 10 msec/division free-running sweep

2. Model 4809A Controls

Control	Setting	Control	Setting
BAND SELECT	1	INPUT ATTEN	0
FREQ SPAN/DIV	as required	IF ATTENUATION	20
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)	IF ATTENUATION VARIABLE	10
FULL SPAN-SIG IDENT	OFF	DISPLAY LAW	10 dB/DIV
RESOLUTION BW	AUTO	VIDEO PROCESSOR	OFF
FREQUENCY STABILIZED	OFF	COARSE TUNE	1.0 GHz

C. TEST SET-UP



D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Make the test set-up shown above.	None	None
2	Set FREQ SPAN/DIV and comb generator to the settings listed below. Adjust COARSE TUNE and FINE TUNE controls to position a comb line on the extreme left graticule marking, and count the number of comb lines displayed.		

FREQ SPAN/DIV	Comb Generator	No. of Comb Lines
100 MHz	100 MHz	11 ±1
10 MHz	10 MHz	11 ±1
1 MHz	1 MHz	11 ±1

6-9. IF SHAPE FACTOR

A. DESCRIPTION

A 260 MHz signal is displayed at six RESOLUTION BW settings. The display width of the signal is then checked 60 dB down from the signal peak.

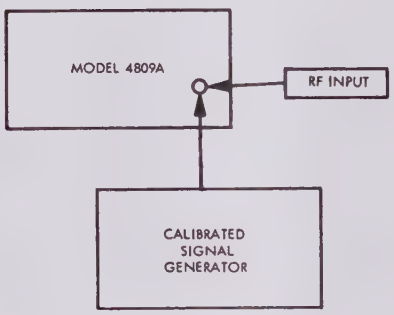
B. PRELIMINARY CONTROL SETTINGS

1. Sweep Speed (Sweep Control Unit): 100 msec/division free-running sweep.

2. Model 4809A Controls

Control	Setting	Control	Setting
BAND SELECT	1	INPUT ATTEN	0
FREQ SPAN/DIV	500 KHz	IF ATTENUATION	10
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)	IF ATTENUATION VARIABLE	10
FULL SPAN-SIG IDENT	OFF	DISPLAY LAW	10 dB/DIV
RESOLUTION BW	1000 KHz	VIDEO PROCESSOR	100 Hz
FREQUENCY STABILIZED	ON	COARSE TUNE	.260 GHz

C. TEST SET-UP



6-9. IF SHAPE FACTOR (continued)

D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Make the test set-up shown above. Set signal generator for 260 MHz, and adjust signal level for full-scale deflection. Center the 260 MHz signal on the display, using the COARSE TUNE and FINE TUNE controls.	None	None
2	Check the width of the signal at the -60 dB line on the LOG scale for each combination of RESOLUTION BW and FREQ SPAN/DIV settings:		

RESOLUTION BW	FREQ SPAN/DIV	Width of Signal at -60 dB	
1000 KHz	500 KHz	≤12 MHz	_____
100 KHz	200 KHz	≤1.2 MHz	_____
10 KHz	20 KHz	≤120 MHz	_____
1 KHz	2 KHz	≤12 KHz	_____
.3 KHz	1 KHz	≤3.6 KHz	_____
.1 KHz	1 KHz	≤1.2 KHz	_____

6-10. AMPLITUDE DISPLAY ACCURACY

A. DESCRIPTION

A 400 MHz signal is presented on band 1. Amplitude display accuracy is checked in the logarithmic and linear display modes.

B. PRELIMINARY CONTROL SETTINGS

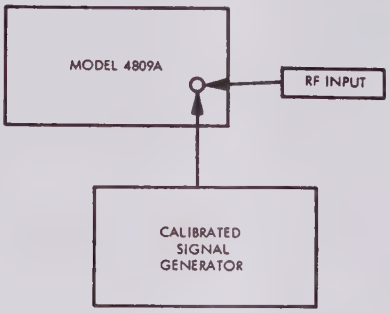
1. Sweep Speed (Sweep Control Unit): 10 msec/division free-running sweep.

2. Model 4809A Controls

Control	Setting	Control	Setting
BAND SELECT	1	INPUT ATTEN	30
FREQ SPAN/DIV	20 KHz	IF ATTENUATION	0
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)	IF ATTENUATION VARIABLE	0
FULL SPAN-SIG IDENT	OFF	DISPLAY LAW	10 dB/DIV
RESOLUTION BW	100 KHz	VIDEO PROCESSOR	100 Hz
FREQUENCY STABILIZED	ON	COARSE TUNE	.400 GHz

6-10. AMPLITUDE DISPLAY ACCURACY (continued)

C. TEST SET-UP



D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Make the test set-up shown above. Set signal generator for 400 MHz at -10 dBm. Adjust CAL screwdriver adjust for full-scale deflection, with 400 MHz response centered.	None	None
2	Reduce the signal generator output level by 70 dB in 10 dB steps. The signal level on the display should decrease in 10 dB steps. Record the maximum deviation in displayed signal amplitude from the signal generator output level.	±2 dB max. deviation	_____
3	Readjust the calibrated signal generator output level for full-scale deflection. Set DISPLAY LAW to 2 dB/DIV, and observe signal amplitude on LOG scale of graticule.	Full-scale ± dB	_____
4	Reduce the signal generator output level by 12 dB in 2 dB steps. The signal level should be reduced one major division for each 2 dB reduction in signal level. Record the maximum deviation in displayed signal amplitude from the signal generator output level.	± db max. deviation	_____
5	Set DISPLAY LAW to LIN, and adjust signal generator output level for full-scale deflection.	None	None
6	Increase INPUT ATTEN to 40 dB, and observe signal amplitude on the LIN scale of the graticule.	2.5 ±0.4 on LIN scale	_____
7	Increase INPUT ATTEN to 50 dB, and observe signal amplitude on the LIN scale of the graticule.	0.8 ±0.4 on LIN scale	_____

6-11. ATTENUATOR ACCURACY

A. DESCRIPTION

The 400 MHz signal from a calibrated signal generator is varied to restore a set signal level on-screen as increments of IF and input attenuation are stepped in.

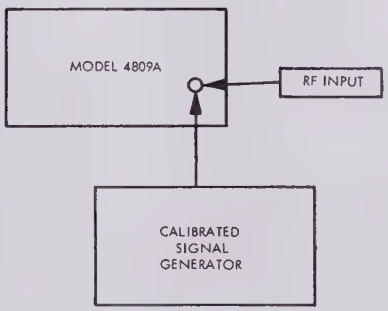
B. PRELIMINARY CONTROL SETTINGS

1. Sweep Speed (Sweep Control Unit): 10 msec/division free-running sweep

2. Model 4809A Controls

Control	Setting	Control	Setting
BAND SELECT	1	INPUT ATTEN	0
FREQ SPAN/DIV	100 KHz	IF ATTENUATION	Noted
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)	IF ATTENUATION VARIABLE	0
FULL SPAN-SIG IDENT	OFF	DISPLAY LAW	LIN
RESOLUTION BW	100 KHz	VIDEO PROCESSOR	100 Hz
FREQUENCY STABILIZED	ON		

C. TEST SET-UP



D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Make the test set-up shown above. Set signal generator for 400 MHz and a calibrated power level of -65 dBm. Adjust COARSE TUNE and FINE TUNE controls to center the signal on the screen.	None	None
2	Adjust IF ATTENUATION to position the signal peak at an amplitude reading of 6 on the LIN scale of the graticule.	None	None
3	Set INPUT ATTEN to each of the following settings, and adjust calibrated signal generator output level to restore the amplitude reading to 6 on the LIN scale of the graticule:	Calibrated signal level (dBm)	

6-11. ATTENUATOR ACCURACY (continued)

D. PROCEDURE (continued)

Step	Action	Spec Limit	Measurement
3	INPUT ATTEN		
	10	-55 ±0.5	_____
	20	-45 ±0.5	_____
	30	-35 ±0.6	_____
	40	-25 ±0.8	_____
	50	-15 ±1.0	_____
	60	-5 ±1.2	_____
4	Return IF ATTENUATION to 0 dB, and set INPUT ATTEN for 10 dB. Adjust signal generator to obtain an amplitude reading of 6 on the LIN scale of the graticule. Record the signal generator ouput level.	None	_____ dBM
5	Set IF ATTENUATION switches for the following if attenuations, and adjust calibrated signal generator to restore the amplitude reading to 6 on the LIN scale of the graticule. Obtain and record incremental change in output level from that recorded in step 4:	Incremental change from step 4	
	IF ATTENUATION (dB)		
	1	+1.0 ±0.5 dBm	_____
	3	+3.0 ±0.5 dBm	_____
	6 (3, 2, and 1 on)	+6.0 ±0.5 dBm	_____
	16 (10, 5, and 1 on)	+16.0 ±0.5 dBm	_____
	36 (20, 10, 5, and 1 on)	+36 ±1.0 dBm	_____
	36 (20, 10, 3, 2, and 1 on)	+36 ±1.0 dBm	_____
	46 (20, 10, 3, 2, and 1 on, and VARIABLE control set to 10)	+46 ±1.5 dBm	_____

6-12. SENSITIVITY

A. DESCRIPTION

The power output of a calibrated signal generator is displayed in each band and adjusted for the specified lower limit. The response is then checked to verify that the signal level is at least 3 dB above the analyzer noise level.

B. PRELIMINARY CONTROL SETTINGS

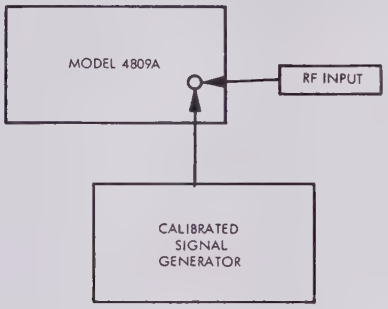
1. Sweep Speed (Sweep Control Unit): 10 msec/division free-running sweep.

2. Model 4809A Controls

6-12. SENSITIVITY (continued)

Control	Setting	Control	Setting
BAND SELECT	1	INPUT ATTEN	0
FREQ SPAN/DIV	200 KHz	IF ATTENUATION	0
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)	IF ATTENUATION VARIABLE	Adjust for good display
FULL SPAN-SIG IDENT	OFF		
RESOLUTION BW	100 KHz	DISPLAY LAW	10 dB/DIV
FREQUENCY STABILIZED	OFF	VIDEO PROCESSOR	100 Hz

C. TEST SET-UP



D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Make the test set-up shown above. Set the calibrated signal generator to the frequency indicated for each band, and adjust the calibrated signal output to the level indicated. Use COARSE TUNE and FINE TUNE controls to center the signal on the screen, and obtain the amount (in dB) that signal exceeds the noise level.		

BAND SELECT	Frequency (GHz)	Input Signal Level (dBM)	Spec Limit	dB above noise level
1	0.4	-95	Signal level shall be at least 3 dB above noise level	_____
2	2.0	-98		_____
3	4.0	-88		_____
4	8.0	-83		_____
5	10.0	-80		_____

6-13. INTERMODULATION DISTORTION

A. DESCRIPTION

Signals from two external signal generators, 1 MHz apart in frequency, are combined and displayed at full-scale amplitude. Intermodulation products are checked.

6-13. INTERMODULATION DISTORTION (continued)

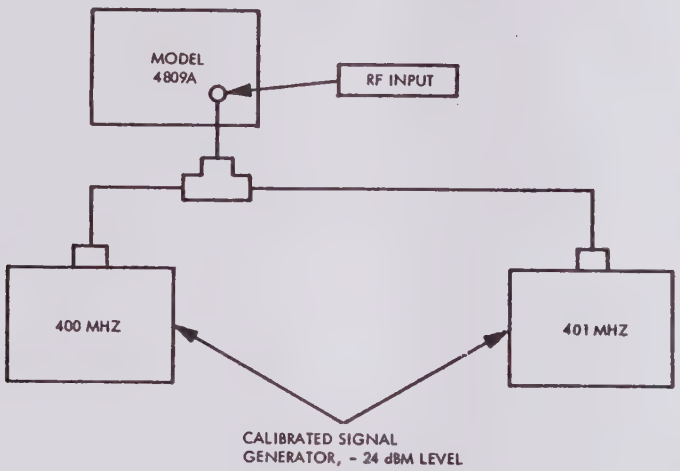
B. PRELIMINARY CONTROL SETTINGS

1. Sweep Speed (Sweep Control Unit): 3 msec/division free-running sweep.

2. Model 4809A Controls

Control	Setting	Control	Setting
BAND SELECT	1	INPUT ATTEN	0
FREQ SPAN/DIV	5 MHz	IF ATTENUATION	0
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)	IF ATTENUATION VARIABLE	0
FULL SPAN-SIG IDENT	OFF	DISPLAY LAW	10 dB/DIV
RESOLUTION BW	100 KHz	VIDEO PROCESSOR	OFF
FREQUENCY STABILIZED	OFF		

C. TEST SET-UP



D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Make the test set-up shown above, combining the two signal generator outputs in a 6 dB tee. Set one signal generator to 400 MHz, -24 dBm, and set the other signal generator to 401 MHz, -24 dBm. Adjust COARSE TUNE and FINE TUNE controls so that the signals are equidistant from the centerline of the display.		
2	Check intermodulation products on the display.	At least 60 dB down from main responses	_____

6-14. FREQUENCY RESPONSE

A. DESCRIPTION

With the appropriate leveled sweeper connected, each band is checked for amplitude deviation as a function of frequency as the band is swept in frequency.

6-14. FREQUENCY RESPONSE (continued)

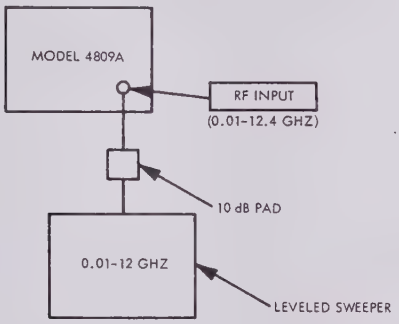
B. PRELIMINARY CONTROL SETTINGS

1. Sweep Speed (Sweep Control Unit): 10 msec/division free-running sweep.

2. Model 4809A Controls

Control	Setting	Control	Setting
BAND SELECT	1	INPUT ATTEN	20
FREQ SPAN/DIV	Any	IF ATTENUATION	Adjust for good
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)	IF ATTENUATION VARIABLE	display
FULL SPAN-SIG IDENT	FULL SPAN	DISPLAY LAW	2 dB/DIV
RESOLUTION BW	1000 KHz	VIDEO PROCESSOR	OFF
FREQUENCY STABILIZED	OFF		

C. TEST SET-UP



D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Make the test set-up shown above, with the appropriate leveled sweeper for each band. Assure that the output of each leveled sweeper has been checked with a power meter, and has been determined to be flat across the range to be swept. Set the signal level for between 0 and -10 dBm.		
2	Slowly tune each sweeper across the indicated range, observing the display for amplitude variations.		

BAND SELECT	Frequency Range	Maximum Amplitude Variation	Amplitude Variation across band
1	0.1 to 1.8 GHz	±1 dB	_____
2	1.75 to 3.75 GHz	±1.5 dB	_____
3	3.0 to 5.0 GHz	±1.5 dBz	_____
4	4.75 to 8.5 GHz	±2 dB	_____
5	8.5 to 12.4 GHz	±2.5 dB	_____

6-15. WAVEGUIDE MIXER CHECKS (Bands 6-8)

A. DESCRIPTION

Leveled sweepers are used to check frequency response and sensitivity for bands 6 to 8.

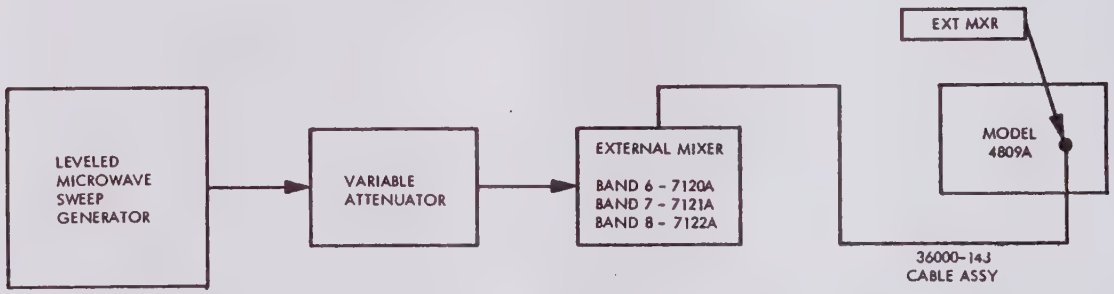
B. PRELIMINARY CONTROL SETTINGS

1. Sweep Speed (Sweep Control Unit): 10 msec/division free-running sweep.

2. Model 4809A Controls

Control	Setting	Control	Setting
BAND SELECT	For band being tested	INPUT ATTEN	10
		IF ATTENUATION	Set for convenient baseline (less than 20 dB)
FREQ SPAN/DIV	500 KHz	IF ATTENUATION VARIABLE	
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)		
FULL SPAN-SIG IDENT	OFF	DISPLAY LAW	100 dB/DIV
RESOLUTION BW	100 KHz	VIDEO PROCESSOR	OFF
FREQUENCY STABILIZED	OFF		

C. TEST SET-UP



D. PROCEDURE

Step	Action	Spec Limit	Measurement
	NOTE *Perform steps 1 through 9 for each band. Restore preliminary control settings before testing a new band.*		
1	Make the test set-up shown above, using a 36000-143 cable to connect the external mixer to the EXT MXR connector. Be sure that cable end marked MIXER is connected to the EXT MXR connector. Assure that the output of each leveled sweeper has been check with a power meter, and has been determined to be flat across the range to be swept.	None	None

6-15. WAVEGUIDE MIXER CHECKS (Bands 6-8) (continued)

Step	Action	Spec Limit	Measurement
	FREQUENCY RESPONSE CHECK		
2	Set the sweep selector control on the sweeper to CW, and set the Start/CW control to the center of the band being swept (15 GHz for band 6, 22 GHz for band 7, 32 GHz for band 8). Use the sweeper dial to determine frequency.	None	None
3	Set variable attenuator in test set-up to 0 dB. Adjust the COARSE TUNE control to the center frequency of the band being check (15 GHz for band 6, 22 GHz for band 7, 32 GHz for band 8), and center the signal on the display with the FINE TUNE control.	None	None
4	Adjust BIAS ADJ control to obtain maximum signal amplitude on the display.	None	None
5	Set frequency of sweeper to the lowest frequency to be tested (12.4 GHz for band 6, 18 GHz for band 7, 26 GHz for band 8). Set leveled output to -30 dBm.	None	None
6	Set FREQ SPAN/DIV to 200 MHz, and RESOLUTION BW to 1000 KHz. Increase the frequency to the sweeper while maintaining the leveled output at -30 dBm. The signal will traverse the display from left to right. As frequency is increased, adjust COARSE TUNE control so that signal remains visible on the display. Continue until maximum frequency has been reached (18 GHz for band 6, 26 GHz for band 7, 40 GHz for band 8). Observe the display for amplitude variations as frequency is swept from low to high end of band.	Maximum Amplitude Variation Band 6-±3 dB Band 7-±4 dB Band 8-±5 dB	Amplitude Variation across band _____ _____ _____
	SENSITIVITY CHECK		
7	Set BAND SELECT to 2, and tune COARSE TUNE to 2.050 GHz. Set VIDEO PROCESSOR to .1 KHz, and set RESOLUTION BW to 100 KHz. Measure the average noise level on the display with no signal input.	Less than -107 dB.	_____
8	Set BAND SELECT to band being tested, and repeat step 5.	None	None
9	Adjust COARSE TUNE and FINE TUNE controls to center the signal on the display. Then, set the input power level to the indicated valve, and obtain the amount (in dB) that signal exceeds the noise level:		

6-15. WAVEGUIDE MIXER CHECKS (continued)

Step	Action	Spec Limit	Measurement
9 (con't)			

BAND SELECT	INPUT POWER LEVEL (dBm)	Signal level shall be at least 3 dB above noise level.	dB above noise level
6	-70		_____
7	-65		_____
8	-55		_____

6-16. REFERENCE VOLTAGE CHECKS

A. DESCRIPTION

The adjustable reference voltages (-13V and -18V) on RF board A211 are checked.

B. PRELIMINARY CONTROL SETTINGS: None

C. TEST SET-UP: None

D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Connect digital voltmeter between dc ground (+) and the following points on RF board A211:		

Test Point	Voltage	
A211TP2	-13.02 to -12.98	_____
A211TP4	-18.05 to -17.95	_____

2 If voltages in step 1 are incorrect, refer to paragraph 7-4.1.1.

6-17. NOISE LEVEL CHECK

A. DESCRIPTION

First, the noise level of the IF section is checked. Then, the noise level of both the RF and IF sections is checked.

B. PRELIMINARY CONTROL SETTINGS

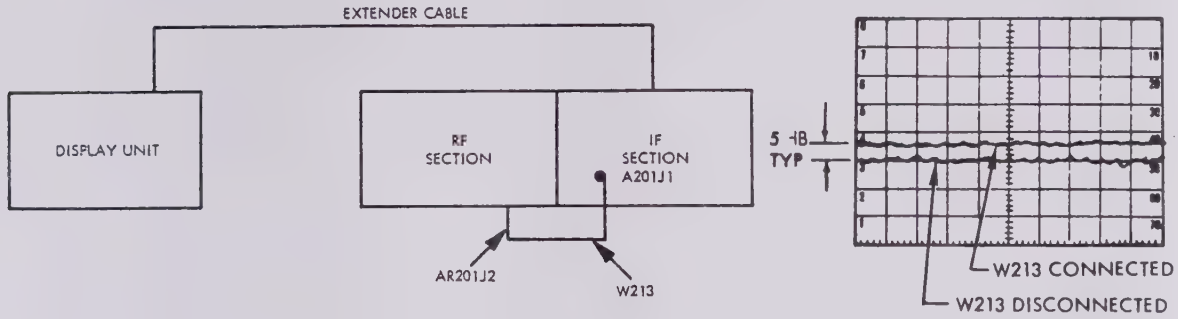
1. Sweep Speed (Sweep Control Unit): 3 msec/division free-running sweep.

2. Model 4809A Controls

6-17. NOISE LEVEL CHECK (continued)

Control	Setting	Control	Setting
BAND SELECT	6	IF ATTENUATION	0
FULL SPAN-SIG IDENT	OFF	IF ATTENUATION VARIABLE	0
RESOLUTION BW	100 KHz	DISPLAY LAW	10 dB/DIV
FREQUENCY STAILIZED	OFF	VIDEO PROCESSOR	100 Hz

C. TEST SET-UP



D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Measure noise level on the display with W213 disconnected from AR201J2, as shown in test set-up diagram above.	Approx. the -50 dB line on the graticule	_____
2	Measure noise level on the display with W213 connected to AR201J2, as shown in test set-up diagram above.	Noise level should increase approx. 5 dB to the -45 dB line	_____

6-18. FIRST LOCAL OSCILLATOR POWER AND RESPONSE CHECK

A. DESCRIPTION

First, the local oscillator output level is checked for flatness across the tuning range. Then, the local oscillator power level is measured.

B. PRELIMINARY CONTROL SETTINGS

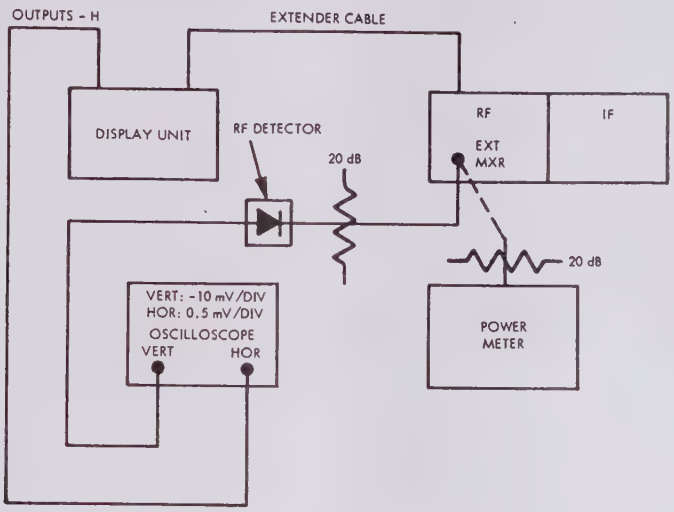
1. Sweep Speed (Sweep Control Unit): 3 msec/division free-running sweep.

2. Model 4809A Controls

6-18. FIRST LOCAL OSCILLATOR POWER AND RESPONSE CHECK (continued)

Control	Setting	Control	Setting
BAND SELECT	1	DISPLAY LAW	10 dB/DIV
FULL SPAN-SIG IDENT	FULL SPAN	RESOLUTION BW	100 KHz

C. TEST SET-UP



D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Check L.O. output displayed on the oscilloscope for flatness.	Amplitude variations shall not exceed ± 2 dB	_____dB
2	Using power meter and 20 dB pad, measure the power level of the L.O. output at the EXT MXR connector.	+12 dBm minimum	_____dBm

6-19. 2050 MHZ IF SENSITIVITY CHECK

A. DESCRIPTION

A 2050 MHz signal is injected at the EXT MXR connector while operating on band 6. Then, the noise level at 2050 MHz is measured. This verifies 2050 MHz sensitivity on bands 6, 7, and 8.

B. PRELIMINARY CONTROL SETTINGS

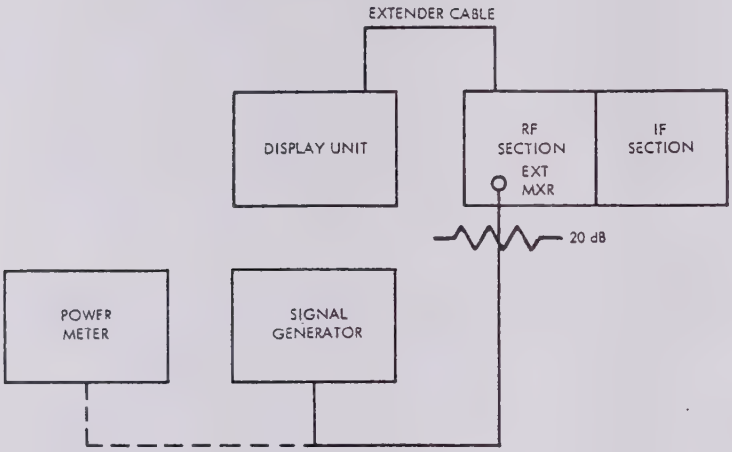
1. Sweep Speed (Sweep Control Unit): 3 msec/division free-running sweep.

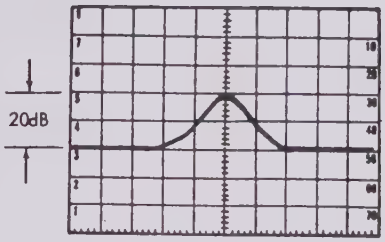
2. Model 4809A Controls

6-19. 2050 MHZ IF SENSITIVITY CHECK (continued)

Control	Setting	Control	Setting
BAND SELECT	6	INPUT ATTEN	0
FREQ SPAN/DIV	100 MHz/DIV	IF ATTENUATION	5 dB
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)	IF ATTENUATION VARIABLE	0
RESOLUTION BW	100 KHz	DISPLAY LAW	10 dB/DIV
COARSE TUNE	15.0 GHz	VIDEO PROCESSOR	100 Hz

C. TEST SET-UP





D. PROCEDURE

Step	Action	Spec Limit	Measurement
1	Set up signal generator for 2050 MHz, and use FINE TUNE control to center the response on the display.	None	None
2	Adjust signal generator output level until signal peak is 20 dB above the noise level. Measure calibrated power level to EXT MXR connect (power meter reading plus 20 dB pad).	-107 dBm maximum	_____

SECTION VII

CALIBRATION

7-1. GENERAL

This section contains instructions for system alignment of the Model 4809A, and for calibrating the individual subassemblies. A complete system alignment is normally performed as the first step of troubleshooting when the Performance Checks in Section VI reveal out-of-tolerance conditions.

Calibration of individual subassemblies is required when the subassembly is replaced, or when the system alignment procedure is not performed successfully. After calibrating an individual subassembly, perform the system alignment to complete the calibration of the tuning unit.

NOTE

Install 50-ohm terminator (AT204) in EXT MXR connector when not operating in bands 6 to 8.

7-1.1 TEST EQUIPMENT

Table 7-1 lists the items of test equipment required for the procedures in this section.

TABLE 7-1. TEST EQUIPMENT REQUIRED FOR CALIBRATION

ITEM	DESCRIPTION	REQUIREMENTS	RECOMMENDED TYPE (or equivalent)
1	Comb Generator	1, 10, and 100 MHz combs	HP8406A
2	Low-Pass Filter	1.8 GHz low-pass	K&L Microwave 5L380-1800-0
3	Oscilloscope		HP1202A
4	Digital Voltmeter (DVM)		S-D 7050
5	Spectrum Analyzer	260 MHz	S-D 762-2
6	Power Meter		HP431C
7	Calibrated Signal Generator		HP8614A
8	Impedance Pads	6 dB, 20 dB	Commercially available
9	Maintenance Kit		S-D Part Number 109606

7-1.2 SEQUENCE OF ADJUSTMENTS

Unless otherwise specified, the sequence of adjustments should be as given in the procedures for a complete calibration of the unit.

7-1.3 USE OF OPTIONAL MAINTENANCE KIT

In the procedures in this section, the tuning unit is aligned in conjunction with the display unit. In some cases, plug-in components must be removed from the chassis for alignment and calibration. The optional maintenance kit (Part Number 109606) includes an extender cable (Part number 36000-090) that permits the display unit to be connected to the tuning unit while the tuning unit is removed for servicing. Also included in the maintenance kit is a card extender (Part number 37000-152) and extender cables (Part Number 36000-163) that permit the circuit boards in the IF section to be removed from the card rack for servicing.

7-1.4 SPECIAL PROCEDURE FOR SYSTEM ALIGNMENT WITH TRACKING PRESELECTOR

When the Model 4745 Tracking Preselector is included in the Model 4809A system, system alignment (see paragraph 7-3) should be performed with the output of the Model 4745 connected to the Model 4809A RF INPUT (bands 1 to 5) or EXT MXR (bands 6 and 7) connector. Input signals should be injected at the input connector of the Model 4745. The FINE TUNE control on the Model 4745 should be adjusted for peak signal amplitude when the signal being analyzed is in bands 2 to 7.

7-2. PRELIMINARY CHECKS

Before performing system alignment or calibration of individual subassemblies, perform the following performance checks in Section VI:

1. Reference Voltage Checks (paragraph 6-16)
2. Noise Level Check (paragraph 6-17)
3. First Local Oscillator Power and Response Checks (paragraph 6-18).

7-3. SYSTEM ALIGNMENT

NOTE

All system alignment adjustments are accessible on the top cover of the unit, and are labeled with their reference designations.

Perform the adjustments in the sequence given. If system alignment is not performed successfully, perform the Detailed Calibration Procedures in paragraph 7-4, and then repeat the System Alignment.

7-3.1 DIAL TRACKING CALIBRATION

Step 1. Make the following control settings:

7-3.1 DIAL TRACKING CALIBRATION (continued)

Control	Setting
BAND SELECT	1
FREQ SPAN/DIV	20 MHz
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)
FULL SPAN-SIG IDENT	OFF
RESOLUTION BW	100 KHz
FREQUENCY STABILIZED	OFF
FINE TUNE	Centered
INPUT ATTEN	10
IF ATTENUATION	Set for full-scale deflection
IF ATTENUATION VARIABLE	Set for full-scale deflection
DISPLAY LAW	10 dB/DIV
VIDEO PROCESSOR	OFF
Sweep Control Unit	3 msec/division free-running sweep, with baseline blanking adjusted to take out noise

Step 2. Make the test connections shown in figure 7-1. Set the comb generator for 100 MHz. Adjust comb generator output level and IF ATTENUATION for full-scale deflection of the 100 MHz comb line.

Step 3. Perform the adjustments in the sequence given:

Sub-Step	Adjustment	Procedure
a	Dial Assy	Turn COARSE TUNE clockwise to stop, and check that pointer stops on dot to the right of the 1.9 GHz scale reading. If pointer error exists, mechanically adjust dial assembly.
b	Dial Assy	Turn COARSE TUNE counterclockwise to stop, and check that pointer stops on dot to the left of scale zero. If pointer error exists, mechanically adjust dial assembly.
c	A211R36 (LO FREQ)	Turn COARSE TUNE so that dial pointer is exactly at scale zero. Adjust A211R36 to position the zero beat signal at screen center.
d	A211R46 (HI FREQ)	Turn COARSE TUNE slowly clockwise, while counting the number of 100 MHz comb lines that traverse past the center line of the display, making sure to identify the 19th comb line (1.9 GHz). With the dial pointer set exactly to 1.9 GHz, adjust A211R46 to position the 19th comb line at screen center.
e	-	Repeat steps c and d as required until zero beat signal and 19th comb line can be centered with dial pointer at zero and 1.9 GHz respectively.
f	-	Set COARSE TUNE to 1.0 GHz, FREQ SPAN/DIV to 100 MHz/DIV. Use FINE TUNE control to center the 1.0 GHz comb line. Observe that a comb line appears on each vertical graticule line. If indication is abnormal, perform the procedure in paragraph 7-4.2.3.

7-3.2 AMPLITUDE CALIBRATION

Step 1. Make the following control settings:

Control	Setting
BAND SELECT	1
FREQ SPAN/DIV	20 MHz/DIV
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)
FULL SPAN-SIG IDENT	OFF
RESOLUTION BW	10 KHz
FREQUENCY STABILIZED	OFF
CAL	Centered
INPUT ATTEN	10
IF ATTENUATION	0
IF ATTENUATION VARIABLE	0
DISPLAY LAW	2 dB/DIV
VIDEO PROCESSOR	100 Hz
Sweep Control Unit	10 msec/division free-running sweep

Step 2. Make the test connections shown in figure 7-2. Set the signal generator for a 100 MHz output, and use COARSE TUNE and FINE TUNE controls to center the 100 MHz response. Adjust signal generator output level for full-scale deflection.

Step 3. Perform the adjustments in the sequence given:

Sub-Step	Adjustment	Procedure
a	Vertical calibration control on Sweep Control Unit	Adjust vertical calibration control so that signal is reduced in amplitude 10 dB (five major divisions) for 10 dB increase in input attenuation introduced by the INPUT ATTEN control.
b	A211R1, A211R3-R8 A211R11-R15, BIAS ADJ	Return INPUT ATTEN to 10 dB, and set DISPLAY LAW to 10 dB/DIV. Set signal generator for a calibrated output level of -30 dBm at each of the following frequencies. For each frequency, center the response on the screen, and adjust the indicated mixer bias adjust for a peak response. Then, adjust the associated 4th converter gain adjustment on RF board A211 to obtain full-scale deflection:

Frequency	BAND SELECT	Mixer Bias Adjust	4th Converter Gain Adjust
100 MHz	1	A211R1	A211R11
2.0 GHz	2	None	A211R12
4.0 GHz	3	A211R3	A211R13
8.0 GHz	4	A211R4	A211R14
10.0 GHz	5	A211R5	A211R15
15.0 GHz	6	BIAS ADJ	A211R6
18.0 GHz	7	BIAS ADJ	A211R7
26.0 GHz	8	BIAS ADJ	A211R8

7-3.2 AMPLITUDE CALIBRATION (continued)

Sub-Step	Adjustment	Procedure
c	-	Select band 1 and set up signal generator for 100 MHz at a calibrated output level of -30 dBm. Center the 100 MHz response (full-scale deflection). Set DISPLAY LAW to 2 dB/DIV. The 100 MHz response should still be at full-scale. If indication is abnormal. Perform the procedure in paragraph 7-4.2.3.
d	-	Refer to paragraph 7-4.2.7 for calibration of 100 MHz calibrator.

7-3.3 PHASE LOCK ADJUSTMENTS

Step 1. Make the following control settings:

Control	Setting
BAND SELECT	1
FREQ SPAN/DIV	100 KHz/DIV
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)
FULL SPAN-SIG IDENT	OFF
RESOLUTION BW	AUTO
FREQUENCY STABILIZED	OFF
COARSE TUNE	.100 GHz
INPUT ATTEN	10
IF ATTENUATION	0
IF ATTENUATION VARIABLE	0
DISPLAY LAW	10 dB/DIV
VIDEO PROCESSOR	OFF
Sweep Control Unit	3 msec/division free-running sweep

Step 2. Make test connections from CAL OUTPUT connector to RF INPUT connector. Adjust FINE TUNE control to center the 100 MHz comb line.

Step 3. Perform the adjustments in the sequence given:

Sub-Step	Adjustment	Procedure
a	A209R37 (DC LEVEL)	Set FREQUENCY STABILIZED to ON. When the FREQUENCY STABILIZED light goes on, adjust A209R37 so that 100 MHz response remains on-screen at a convenient display position.

7-3.4 POST-ALIGNMENT SENSITIVITY CHECKS

Perform the sensitivity checks in paragraphs 6-12 and 6-19.

7-4. DETAILED CALIBRATION PROCEDURES

NOTE

After performing any of the calibration procedures in the paragraphs that follow, the System Alignment in paragraph 7-3 should be performed.

7-4. DETAILED CALIBRATION PROCEDURES (continued)

Detailed calibration procedures are provided for the RF Section and the IF Section. For a complete calibration, perform the procedures in the sequence given, followed by the System Alignment in paragraph 7-3.

7-4.1 RF SECTION CALIBRATION

Calibration of the RF Section should normally be performed with the Microwave Chassis and IF Chassis separated. To separate the Microwave Chassis (RF Section), proceed as follows:

Step 1. Remove four 6-32 screws that secure the bottom cover of the unit, and remove the bottom cover.

Step 2. Disconnect ribbon cable W215 from A206J1.

Step 3. Disconnect semi-rigid cable W205 from input attenuator (AT201) connector J2.

Step 4. Remove COARSE TUNE knob.

Step 5. Remove 50-ohm termination from EXT MXR connector.

NOTE

The front panel EXT MXR connector should have the 50-ohm termination applied at all times except when in use.

Step 6. With unit in upright position, remove three 6-32 screws from each side of chassis, and two 6-32 screws at rear of chassis. These eight screws are color-coded green. Then, slide the microwave chassis away from the front panel to clear the frequency tune shaft, and lift the chassis straight up.

Step 7. Remove cable W213 at AR201J2 of the 260 MHz amplifier.

Step 8. Connect ribbon cable W215 back to A206J1.

Step 9. Connect semi-rigid extender cable between cable W205 and AT201J2.

Step 10. Replace the COARSE TUNE knob.

Step 11. Connect semi-rigid extender cable between cable W213 and AR201J2.

To re-install the microwave chassis after RF section calibration is complete, proceed as follows:

Step 1. Disconnect cable between W213 and AR201J2.

Step 2. Remove the COARSE TUNE knob.

Step 3. Disconnect cable between W205 and AT201J2.

Step 4. Disconnect ribbon cable W215 from A206J1.

7-4.1 RF SECTION CALIBRATION (continued)

Step 5. Place the microwave chassis back in position in the frame, and secure with two 6-32 screws at rear, and three 6-32 screws on each side of chassis.

Step 6. Connect cable W213 back to AR201J2.

Step 7. Replace COARSE TUNE knob.

Step 8. Connect cable W205 back to AT201J2.

Step 9. Connect ribbon cable W215 back to A206J1.

Step 10. Place bottom cover in position, and secure with four 6-32 screws.

Step 11. Replace the 50-ohm termination on the EXT MXR connector.

7-4.1.1 DC REFERENCE VOLTAGE CALIBRATION (A211)

NOTE

See RF Board diagram in Section IX for location of adjustments.

Step 1. Connect digital voltmeter to A211TP4, and adjust -18 VDC adjust A211R51 for -18 ±0.05 volts.

Step 2. Connect digital voltmeter to A211TP2, and adjust -13 VDC adjust A211R41 for -13 ±0.02 volts.

7-4.1.2 SECOND LOCAL OSCILLATOR FREQUENCY CALIBRATION (Y202)

NOTE

Before performing these adjustments, perform the procedure in paragraph 7-4.1.1.

Step 1. Make the following control settings:

Control	Setting
BAND SELECT	2
FREQ SPAN/DIV	5 MHz/DIV
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)
FULL SPAN-SIG IDENT	OFF
RESOLUTION BW	100 KHz
FREQUENCY STABILIZED	OFF
INPUT ATTEN	10
IF ATTENUATION	0
IF ATTENUATION VARIABLE	0
DISPLAY LAW	10 dB/DIV
VIDEO PROCESSOR	OFF
Sweep Control Unit	10 msec/division free-running sweep

Step 2. Make the test connections shown in figure 7-3. Set up the comb generator for a 10 MHz comb. Adjust FINE TUNE control for maximum baseline rise, as shown in figure 7-3A.

7-4.1.2 SECOND LOCAL OSCILLATOR FREQUENCY CALIBRATION (Y202) (continued)

Step 3. Perform the adjustments in the sequence given:

Sub-Step	Adjustment	Procedure
a	-	Set BAND SELECT to 1, COARSE TUNE to 260 MHz, FREQ SPAN/DIV to 20 MHz, and IF ATTENUATION to 20 dB. Adjust baseline blanking to blank out noise on the display.
b	Y202 tuning slug (see figure 5-1)	Set up comb generator for a 100 MHz comb, and adjust Y202 tuning slug to obtain coincidence between short and tall comb lines, as shown in figure 7-3B.

7-4.1.3 FIRST MIXER (Z202) AND BP-LP FILTER (FL201) RESPONSE

Step 1. Make the following control settings:

Control	Setting
BAND SELECT	1
FREQ SPAN/DIV	50 MHz/DIV
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)
FULL SPAN-SIG IDENT	OFF
RESOLUTION BW	100 MHz
FREQUENCY STABILIZED	OFF
INPUT ATTEN	10
IF ATTENUATION	4 dB
IF ATTENUATION VARIABLE	0
DISPLAY LAW	10 dB/DIV
VIDEO PROCESSOR	OFF
Sweep Control Unit	10 msec/division free-running sweep

Step 2. Make the test connections shown in figure 7-4. Set up the external spectrum analyzer as indicated in figure 7-4.

Step 3. Perform the adjustments in the sequence given:

Sub-Step	Adjustment	Procedure
a	2050 MHz IF tuning slugs A, B, and C on FL201 (see figure 5-1)	Check the display on the external spectrum analyzer, centered on the 260 MHz response. Adjust tuning slugs to obtain a flat response at least from 255 MHz to 265 MHz (see figure 7-4A).
b	1ST MXR IF ADJ output cavity tuning slug on Z202	If necessary to achieve a flat response, adjust the output cavity tuning slug on Z202.

7-4.2 IF SECTION CALIBRATION

Calibration of the IF section is normally performed with the tuning unit assembled and connected to the display unit by the extender cable. The bottom cover of the tuning unit should be removed. Access to controls on printed circuit boards requires (in some instances) that the board be removed from the chassis and installed on the extender board, which is then installed in the chassis.

NOTE

Whenever possible, calibration should be performed with the circuit boards installed in the chassis. If extender board must be used, make certain that good ground contact is obtained when re-installing the board in the chassis after finishing with the extender board.

7-4.2.1 THIRD CONVERTER BOARD (A201)

NOTE

Before performing these adjustments, perform steps 1 through 3 a of the procedure in paragraph 7-4.2.3. See 3rd converter diagram in Section IX for location of adjustments.

Step 1. Make the following control settings:

Control	Setting
BAND SELECT	1
FREQ SPAN/DIV	500 KHz/DIV
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)
FULL SPAN-SIG IDENT	OFF
RESOLUTION BW	10 KHz
FREQUENCY STABILIZED	OFF
DISPLAY LAW	10 dB/DIV
VIDEO PROCESSOR	OFF
Sweep Control Unit	3 msec/division free-running sweep

Step 2. Make the test connections shown in figure 7-5, with board A201 on the extender board. To make the test connections, disconnect cable W213 from A201J1, and connect the comb input to A201J1. Also, connect an extender cable from A201J2 to A202J2 on 4th converter board. Set up the comb generator for a 10 MHz comb.

Step 3. Perform the adjustments in the sequence given:

Sub-Step	Adjustment	Procedure
a	A201R47, A201R57, A201R58 A201R68	Set all four adjustments fully clockwise.

7-4.2.1 THIRD CONVERTER BOARD (A201) (continued)

Sub-Step	Adjustment	Procedure
b	A201C7 (thru hole in cover)	Set FINE TUNE control to a mid-range setting (use comb line for reference). Then adjust A201C7 to center the 260 MHz response (comb line) on the display.
c	A201R67	Set comb generator for 1 MHz interpolation markers. Turn FINE TUNE clockwise until all five sidebands to the right of the 260 MHz response are exposed. Adjust A201R67 to place the 260 MHz response on the screen.
d	A201R69	If required to improve 3rd local oscillator linearity, adjust A201R69 (on oscillator board adjacent to A201C7). To gain access to this adjustment, oscillator cover must be removed.
e	A201R25	Adjust to obtain uniform spacing of the sidebands, aligned on the graticule lines two divisions apart (±1 minor division).
f	A201R43	Turn FINE TUNE counterclockwise until all five sidebands to left of the 260 MHz response are exposed, or until 260 MHz response is aligned at right-hand edge of graticule. Adjust A201R43 to position the outboard (5th) sideband at the left-hand edge of the graticule. Then, shift A201R43 to move the 4th sideband one-quarter major division to the left.

NOTE

The steps that follow will move the 5th sideband toward the left-hand edge of the graticule. Presetting A201R43 in step f is intended to assure that movement will not carry the 5th sideband to the right of the graticule line. If a shift to the right of the line does occur, readjust A201R43.

g	A201R61	Adjust counterclockwise to align the first sideband on the second graticule line from the right-hand edge.
h	A201R58	Align 2nd sideband on fourth graticule line from right-hand edge.
i	A201R57	Align 3rd sideband on sixth graticule line from right-hand edge.
j	A201R47	Align 4th sideband on eight graticule line from right-hand edge.
k	A201R43	If necessary, readjust A201R43 to align the 5th sideband on the left-hand graticule line. Repeat steps g through j as necessary to complete the calibration of all five sidebands, so that all five are aligned on graticule lines.

7-4.2.2 LIN-LOG AMPLIFIER BOARD (A205)

NOTE

See Lin-Log Amplifier diagram in Section IX for location of adjustments.

Step 1. Make the following control settings:

Control	Setting
BAND SELECT	1
FREQ SPAN/DIV	200 KHz/DIV
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)
FULL SPAN-SIG IDENT	OFF
RESOLUTION BW	100 KHz
FREQUENCY STABILIZED	OFF
COARSE TUNE	.100 GHZ
CAL	Centered
DISPLAY LAW	LIN
VIDEO PROCESSOR	100 Hz
Sweep Control Unit	3 msec/division free-running sweep

Step 2. Make the test connections shown in figure 7-1, with board A205 on extender board. Set up comb generator for a 10 MHz comb.

Step 3. Perform the adjustments in the sequence given:

Sub-Step	Adjustment	Procedure
a	A205C44	Use COARSE and FINE TUNE controls to center a comb line on the display. Use INPUT ATTEN and IF ATTENUATION controls to set the signal amplitude near full-scale. Adjust A205C44 for peak amplitude of the comb line.
b	A205R62 (Zero)	Set RESOLUTION BW to 1 KHz, and adjust A205R62 to align the trace on the graticule baseline.
c	A205R58 (Lin)	Set RESOLUTION BW to 100 KHz. Using comb generator output level control and IF ATTENUATION set signal level so that signal peak is at 2.5 on left-hand graticule scale. Then, increase IF ATTENUATION by 10 dB, and adjust A205R58 for full-scale deflection.
d	A205C44 A205R62 A205R58	Repeat steps a through c as required.
e	A201R45 (Log)	Set DISPLAY LAW switch to 10 dB/DIV, and reduce IF ATTENUATION to zero. Set INPUT ATTEN to 10, and adjust comb generator output level for full-scale deflection. Then, increase IF ATTENUATION in 10 dB steps, and adjust A201R45 so that amplitude is reduced 10 $\pm$2 dB for each 10 dB increase in IF ATTENUATION.

7-4.2.3 HARMONIC ATTENUATOR/VIDEO FILTER (A206)

NOTE

See Harmonic Attenuator/Video Filter diagram in Section IX for location of adjustments.

Step 1. Make the following control settings:

Control	Setting
BAND SELECT	1
FREQ SPAN/DIV	10 MHz/DIV
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)
FULL SPAN-SIG IDENT	OFF
RESOLUTION BW	100 KHz
FREQUENCY STABILIZED	OFF
CAL	Centered
INPUT ATTEN	0
IF ATTENUATION	As required for full-scale deflection
IF ATTENUATION VARIABLE	As required for full-scale deflection
DISPLAY LAW	10 dB/DIV
VIDEO PROCESSOR	OFF
Sweep Control Unit	3 msec/division free-running sweep

Step 2. Make the test connections shown in figure 7-1. Set comb generator for a 10 MHz comb, and adjust comb generator output level and IF ATTENUATION for full-scale deflection. Center one of the comb lines.

Step 3. Perform the adjustments in the sequence given:

Sub-Step	Adjustment	Procedure
a	A206R3 (Sweep Amp Cal)	Adjust to align the 10 MHz comb lines on the vertical lines of the graticule.
b	A206R39 (2 dB Offset)	Set DISPLAY LAW to 2 dB/DIV, and adjust A206R39 for full-scale deflection of the 10 MHz comb lines.

7-4.2.4 6.5 MHZ CRYSTAL FILTER BOARDS (A204, A208)

NOTE

See 6.5 MHz Crystal Filter diagram in Section IX for location of adjustments.

Step 1. Make the following control settings:

Control	Setting
BAND SELECT	1
FREQ SPAN/DIV	50 MHz/DIV
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)
FULL SPAN-SIG IDENT	OFF

7-4.2.4 6.5 MHZ CRYSTAL FILTER BOARDS (A204, A208) (continued)

Control	Setting
RESOLUTION BW	100 KHz
FREQUENCY STABILIZED	ON
CAL	Centered
INPUT ATTEN	10
IF ATTENUATION	0
IF ATTENUATION VARIABLE	0
DISPLAY LAW	10 dB/DIV
VIDEO PROCESSOR	OFF
Sweep Control Unit	10 msec/division free-running sweep

Step 2. Make the test connections shown in figure 7-2. Set up signal generator for a 400 MHz output at -30 dBm. The 400 MHz response should be at full-scale. If not, adjust A211R11 for full-scale deflection. Center the 400 MHz response.

Step 3. Perform the adjustments in the sequence given:

Sub-Step	Adjustment	Procedure
a	-	Set RESOLUTION BW to 1000 KHz. The 400 MHz response should be at full-scale, ±2 dB.
b	R93, R99, R87, R86	Set RESOLUTION BW to each of the following settings, and adjust for full-scale deflection:

RESOLUTION BW	Adjustment on A208/A204
10	R93
1	R99
.3	R87
.1	R86

7-4.2.5 100 KHZ BANDPASS FILTER BOARD (A203)

NOTE

See 100 KHz Bandpass Filter diagram in Section IX for location of adjustments.

Step 1. Make the following control settings:

Control	Setting
BAND SELECT	1
FREQ SPAN/DIV	500 KHz/DIV
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)
FULL SPAN-SIG IDENT	OFF
RESOLUTION BW	1000 KHz
FREQUENCY STABILIZED	OFF
CAL	Centered
INPUT ATTEN	10
IF ATTENUATION	0

7-4.2.5 100 KHZ BANDPASS FILTER BOARD (A203) (continued)

Control	Setting
IF ATTENUATION VARIABLE	0
DISPLAY LAW	10 dB/DIV
VIDEO PROCESSOR	OFF
Sweep Control Unit	10 msec/division free-running sweep

Step 2. Make the test connections shown in figure 7-2. Set up signal generator for a 400 MHz output at -30 dBm, and center the 400 MHz response with the COARSE and FINE TUNE controls.

Step 3. Perform the adjustments in the sequence given:

Sub-Step	Adjustment	Procedure
a	A203R13 (100 KHz Amp)	Set RESOLUTION BW to 100 KHz, FREQ SPAN/DIV to 100 KHz, and adjust FINE TUNE to re-center the 400 MHz response. Adjust A203R13 for full-scale deflection.
b	A203R32 (10 dB Adj)	Set DISPLAY LAW to LIN and adjust signal generator output level for full-scale deflection. Then, turn IF ATTENUATION VARIABLE control to 10 dB. Adjust A203R32 so that signal peak is at 2.5 on left-hand scale.
c	-	Adjust IF ATTENUATION for a signal peak at the 7 division line on the left-hand scale. Check for a signal width of 2 major divisions ±1 minor division at the 5 division line on the left-hand scale.
d	A203C13 A203C15 A203C17 A203C19	Adjust to obtain peak amplitude and best symmetry of the 400 MHz response.
e	A203R13 A203R32	Set DISPLAY LAW to 10 dB/DIV, IF ATTENUATION to 0, IF ATTENUATION VARIABLE to 0. Set signal generator output level to -30 dBm, and repeat steps a and b.

7-4.2.6 FOURTH CONVERTER BOARD (A202)

NOTE

See 4th Converter diagram in Section IX for location of adjustments.

Step 1. Make the following control settings:

Control	Setting
BAND SELECT	1
FREQ SPAN/DIV	500 KHz/DIV
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)
FULL SPAN-SIG IDENT	OFF

7-4.2.6 FOURTH CONVERTER BOARD (A202) (continued)

Control	Setting
RESOLUTION BW	10 KHz
FREQUENCY STABILIZED	OFF
INPUT ATTEN	0
DISPLAY LAW	LIN
VIDEO PROCESSOR	OFF
Sweep Control Unit	3 msec/division free-running sweep

Step 2. Make the test connections shown in figure 7-6, with board A202 on the extender board. To make the test connections, disconnect cable W213 from A201J1, and connect the comb signal input to A201J1. Also, connect an extender cable from A201J2 to A202J2. Set up the comb generator for a 10 MHz comb. Adjust FINE TUNE control to center the 260 MHz response (comb line) on the display.

Step 3. Perform the adjustments in the sequence given:

Sub-Step	Adjustment	Procedure
a	-	Set RESOLUTION BW to 1000 KHz, and adjust IF ATTENUATION to position the signal peak at the 7 division line on the left-hand scale. Check for a signal width of 2 major divisions ±1 minor division at the 5 division line on the left-hand scale.
b	A202C3, A202C12 A202C20 A202C26 A202C28, A202C30 A202C31 A202C37	Adjust to obtain peak amplitude and best symmetry of the 260 MHz signal.

7-4.2.7 100 MHZ CALIBRATOR (A207)

NOTE

See 100 MHz Calibrator diagram in Section IX for location of adjustments.

Step 1. Make the following control settings:

Control	Setting
BAND SELECT	1
FREQ SPAN/DIV	100 KHz
FREQ SPAN/DIV VARIABLE	Fully CW (OFF)
FULL SPAN-SIG IDENT	OFF
RESOLUTION BW	AUTO
FREQUENCY STABILIZED	OFF
CAL	Centered
COARSE TUNE	0.100 GHz
INPUT ATTEN	10

7.4.2.7 100 MHZ CALIBRATOR (A207)

Control	Setting
IF ATTENUATION	0
IF ATTENUATION VARIABLE	0
DISPLAY LAW	10 dB/DIV
VIDEO PROCESSOR	OFF
Sweep Control Unit	Set up for AUTO sweep.
A207R19	Mid-range

Step 2. Make the test connections shown in figure 7-1, using a comb generator with a calibrated frequency accuracy of ±.001% or better. Set up the comb generator for a 100 MHz comb, and set output level for full-scale deflection.

Step 3. Perform the adjustments in the sequence given:

Sub-Step	Adjustment	Procedure
a	-	Adjust FINE TUNE to center the 100 MHz comb line. Then progressively reduce FREQ SPAN/DIV to 1 KHz while re-centering the signal peak of the 100 MHz comb line with the FINE TUNE control.
		NOTE *DO NOT disturb settings of COARSE TUNE and FINE TUNE controls in step b.*
b	-	Disconnect the comb generator from the low-pass filter, and make the connection from CAL OUTPUT connector to low-pass filter. The signal peak of the 100 MHz comb response should appear on the display within 1 major division (±1 KHz) of the center line of the display.
c	A207C18	Set FREQ SPAN/DIV to 200 KHz. Adjust FINE TUNE to center the 100 MHz comb line. Then, adjust A207C18 for full-scale deflection of the 100 MHz comb line.
d	A207C10 A207C22	Set RESOLUTION BW to 1000, and operate FULL SPAN/SIG IDENT switch to FULL SPAN. Adjust A207C10 and A207C22 for best comb response from 200 MHz to 1.8 GHz. Comb lines must be visible to 1.8 GHz, with a minimum level of -65 dBm.
e	-	Return FULL SPAN/SIG IDENT to OFF, and set RESOLUTION BW to 100 KHz. Set FREQ SPAN/DIV to 200 KHz. Disconnect the CAL OUTPUT connection to the low-pass filter, and connect the signal generator to the low-pass filter. Set up the signal generator for an output of 100 MHz at a calibrated level of -30 dBm at input to low-pass filter, using power meter. Adjust FINE TUNE to center the 100 MHz response.
f	-	Set DISPLAY LAW to LIN, and adjust IF ATTENUATION controls to obtain full-scale deflection of 100 MHz response while maintaining signal generator output level at a calibrated -30 dBm.

Sub-Step	Adjustment	Procedure

NOTE

DO NOT disturb settings of FREQ SPAN/DIV, INPUT ATTEN, and IF ATTENUATION controls in step g.

g	A207R19 (100 MHz Amp)	Disconnect the signal generator from the low-pass filter, and make the connection from the CAL OUTPUT connector to the low-pass filter. Without disturbing INPUT ATTEN and IF ATTENUATION settings, adjust A207R19 to obtain full-scale deflection of the 100 MHz comb line. If A207R19 has insufficient range, A207C18 may be re-adjusted as required.

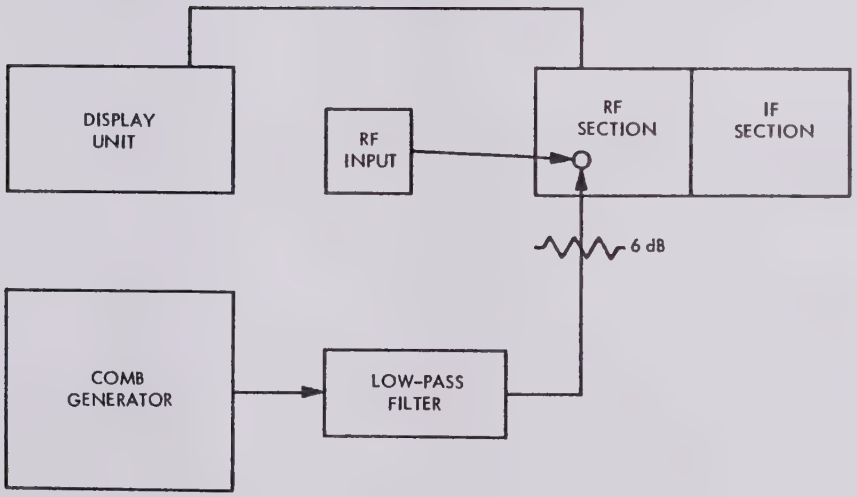


Figure 7-1. Comb Generator Test Set-Up

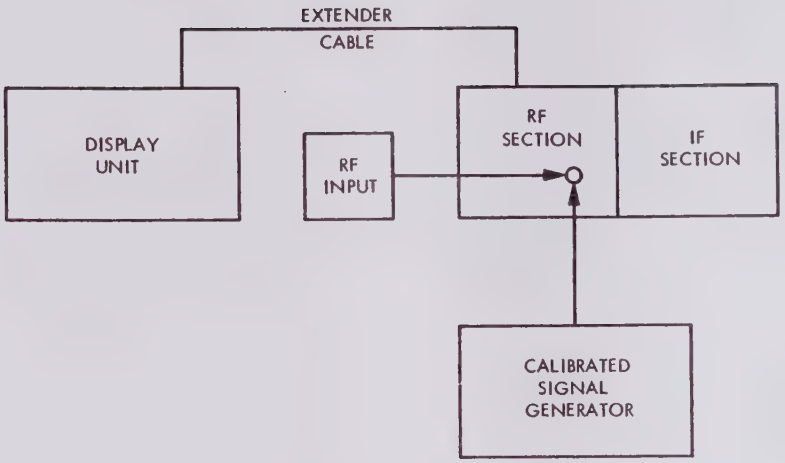


Figure 7-2. Signal Generator Test Set-Up

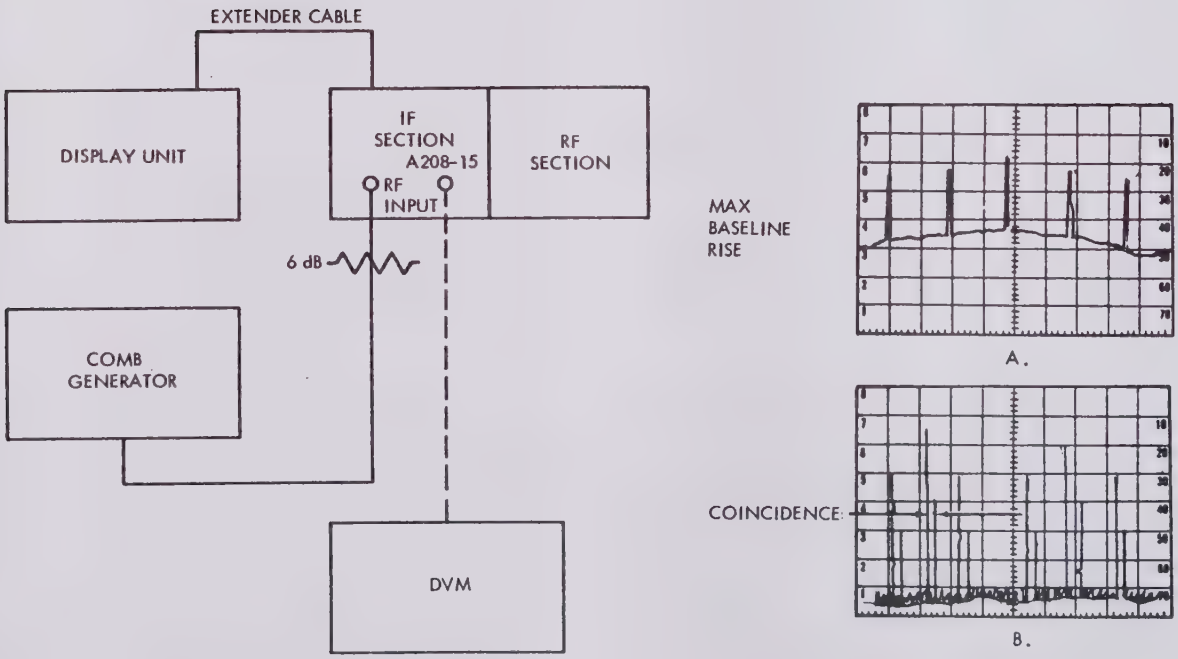


Figure 7-3. Y202 Second L.O. Test Set-Up

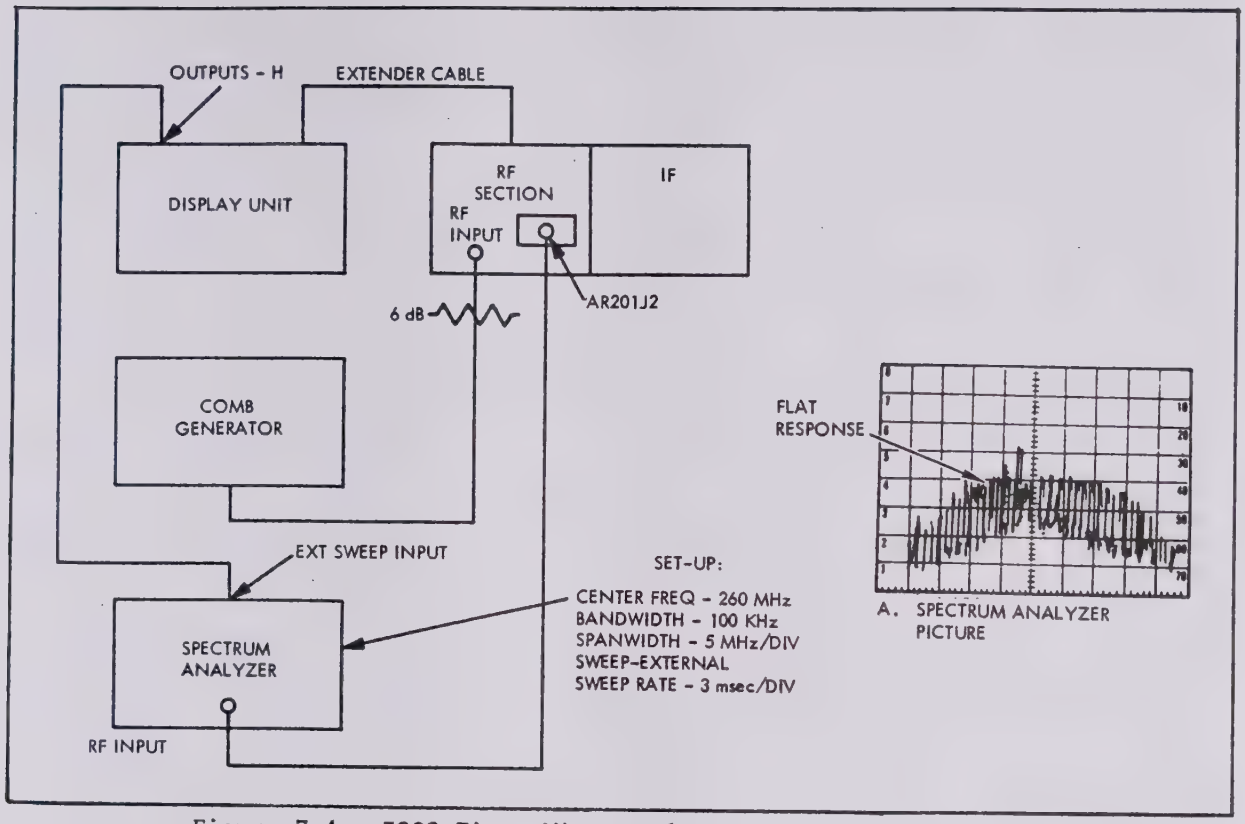


Figure 7-4. Z202 First Mixer and BP-LP Filter Test Set-Up

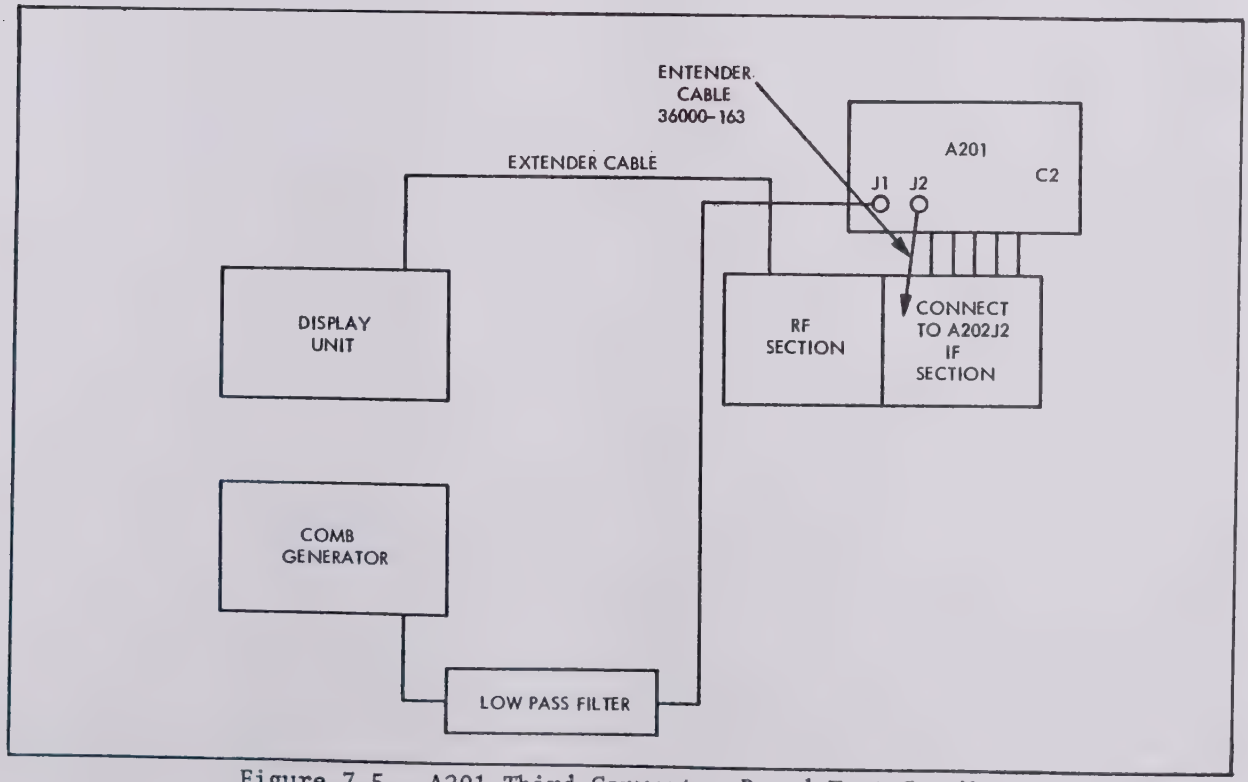


Figure 7-5. A201 Third Converter Board Test Set-Up

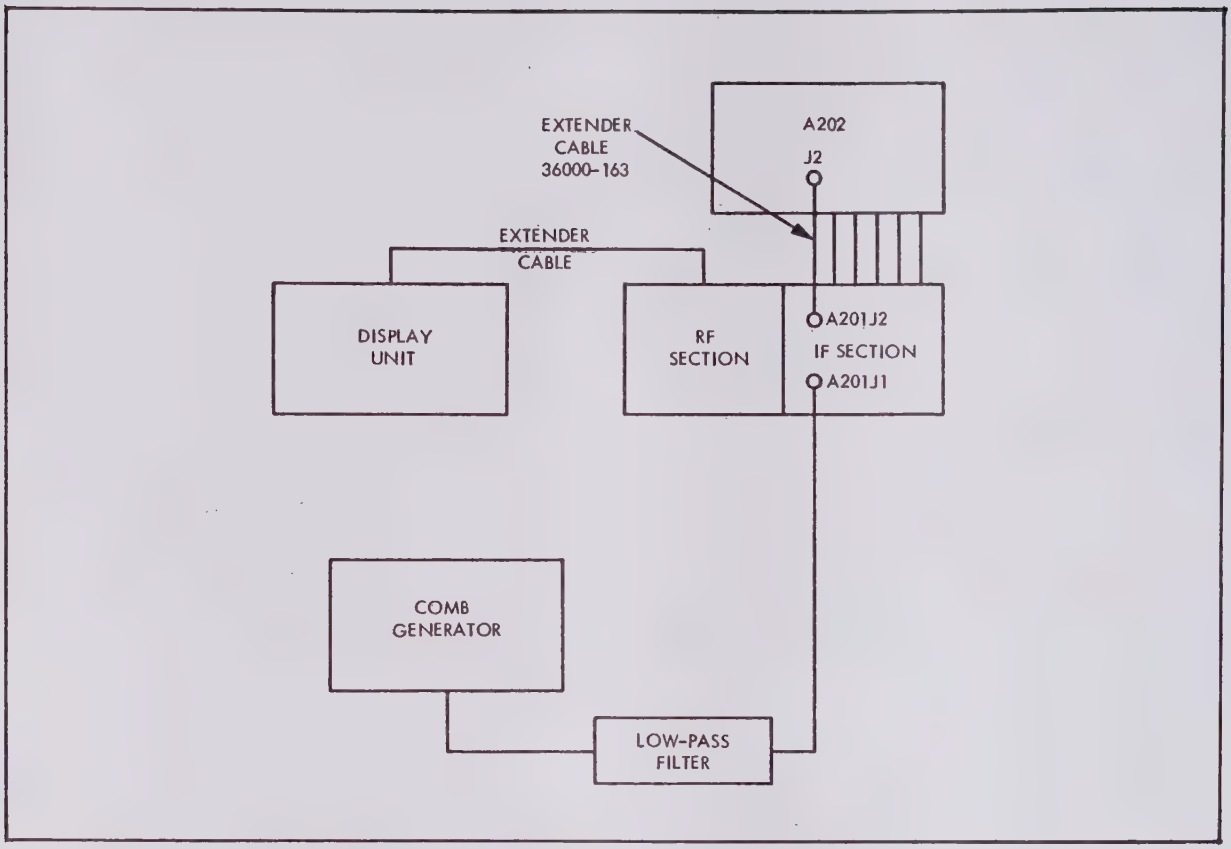


Figure 7-6. Fourth Converter Test Set-Up

SECTION VIII

REPLACEABLE PARTS LIST

8-1. INTRODUCTION

This section lists replaceable parts for the Model 4809A Microwave Tuning Unit.

8-2. EXPLANATION OF COLUMNS

FIGURE NO. This column references the figure number in which the part can be located.

REFERENCE DESIGNATION. Parts are listed in sequence by reference designation and may be located on the schematic diagram or other reference figure by this designator.

PART NUMBERS. Standard parts are identified by both a Systron-Donner and the standard part number. Non-Standard parts not manufactured or controlled by Systron-Donner are identified by both a Systron-Donner and the manufacturer's part number.

MFR. The five-digit federal manufacturers code, as listed in Cataloging Handbook H4-1 and H4-2, are listed in this column. These codes and corresponding manufacturers are listed in paragraph 8-3.

DESCRIPTION. Descriptions of component parts of subassemblies are indented to indicate the parts comprising each subassembly.

8-3. MANUFACTURER'S CODES

CODE	NAME
00656	Averovox Corp. New Bedford, Ma.
01121	Allen Bradley Co. Milwaukee, Wi.
01220	Systron Donner Corp. Microwave Division Van Nuys, Calif.
01281	TRW Inc., Semiconductor Div. Lawndale, Calif.
01686	RCL Electronics Inc. Manchester, N. H.
02111	Spectrol Electronics Corp. City of Industry, Calif.
02114	Ferroxcube Corp. Saugerties, N. Y.

CODE	NAME
02660	Bunker Ramo Corp., Connector Div., Broadview, Ill.
02799	Arco/LDF Torrance, Calif.
04713	Motorola, Inc., Semiconductor Prod., Div. Phoenix, Ariz.
07263	Fairchild Semiconductor Mountain View, Calif.
09353	C and K Components Inc. Watertown, Ma.
10021	Heg Corp. Livonia, Minn.
11236	CTS of Berne Inc. Berne, In.
12040	National Semiconductor Corp. Danbury, Ct.
14655	Cornell-Dubilier Electronics Div. of Federal Pacific Electrics Co. Newark, N. J.
14693	Corry Jamestown Corp. Corry, Pa.
14752	Electro Cube Inc. San Gabriel, Calif.
15003	Valor Electronics, Inc. Santa Ana, Calif.
21317	Electronic Applications Co. South El Monte, Calif.
21604	Buckeye Stamping Co. Columbus, Ohio
21847	Aertech Sunnyvale, Calif.
24602	EMC Technology Inc. Philadelphia, Pa.
26805	American Microwave Industries Inc. Waltham, Ma.

CODE	NAME
27014	National Semi-Conductor Corp. Santa Clara, Calif.
28480	Hewlett-Packard Corp. Palo Alto, Calif.
32159	West-Cap Arizona Tucson, Ariz.
32997	Bournes Inc., Trimpot Products Div. Riverside, Calif.
33801	Precision System Inc. Waltham, Ma.
43543	Nytronics Inc., Transformer Co. Div. Alpha, N. J.
56289	Sprague Electric Co. North Adams, Ma.
71279	Cambridge Thermionic Corp. Cambridge, Ma.
71450	CTS Corp. Elkhart, In.
71590	Globe-Union Inc., Centralab Div. Milwaukee, Wis.
72136	Electro Motive Mfg. Co. Inc. Willimantic, Ct.
72982	Erie Technological Products Inc. Erie, Pa.
73138	Beckman Instruments Inc., Helipot Div. Fullerton, Calif.
75037	Minnesota Mining & Mfg., Co. Electro Products Div. St. Paul, Minn.
80294	Bournes, Inc. Riverside, Calif.
81312	Winchester Electronics Division, Litton Industries Inc. Oakville, Ct.
88245	Litton Precision Products Inc., USECO Div. Litton Industries Van Nuys, Calif.

CODE	NAME
89110	Amp Inc., Capitron Div. Elizabethtown, Pa.
90201	Mallory Capacitor Co. Indianapolis, Ind.
91506	Augat Inc. Attleboro, Ma.
95037	Atwater-General Corp. New Berlin, Wi.
95146	Alco Electronics Products Inc. Lawrence, Ma.
98291	Sealectro Corp. Mamaroreck, N. Y.
99800	Delevan Electronics Corp. East Aurora, N. Y.

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A201	10920401			BOARD ASSY - 3RD CONVERTER Consisting of:	1
A201AR1, AR2, AR3, AR4	107322	U5B7741393	07263	INTEGRATED CKT	4
A201C13, 14	107291	TG-S10	56289	CAPACITOR, .01 uf, 100V, 20%	2
A201C15, C16	107290	DM15-501J	02799	CAPACITOR, 500 pf, 500V, 5%	2
A201C17	107041	196D106X9020JA1	56289	CAPACITOR, 10 uf, 20V, 10%	1
A201C18	107039	8131-100-651 104M	72982	CAPACITOR, .1 uf, 100V, 20%	1
A201C19	100243	DM15-102J	02799	CAPACITOR, 1000 pf, 100V, 5%	1
A201C20	107041	196D106X9020JA1	56289	CAPACITOR, 10 uf, 20V, 10%	1
A201C22, C23, C24	107310	SC27BX102KS	32159	CAPACITOR, CHIP, 1000 pf, 50V	3
A201CR3	107042	1N914		DIODE, SWITCHING	1
A201CR4	107312	1N823A		DIODE	1
A201CR5	107042	1N914		DIODE, SWITCHING	1
A201FL1	109205			FILTER	1
A201J2	107341	52-054-0000	98291	CONNECTOR	1
A201Q2	102714	2N3694		TRANSISTOR	1
A201Q3, Q4	107011	2N3641		TRANSISTOR	2
A201Q5	102714	2N3694		TRANSISTOR	1
A201Q6	101360	2N3638		TRANSISTOR	1
A201Q7	107011	2N3641		TRANSISTOR	1
A201Q8	102714	2N3694		TRANSISTOR	1
A201Q9, Q10	101378	2N3906		TRANSISTOR	2
A201Q11	107011	2N3641		TRANSISTOR	1
A201Q12, Q13	101378	2N3906		TRANSISTOR	2
A201Q14	107499	2N699B		TRANSISTOR	1
A201Q15, Q16	101378	2N3096		TRANSISTOR	2
A201Q17	107214	2N3694		TRANSISTOR	1
A201R9	107254	RN55D1502F		RESISTOR, 15K, 1/8W, 1%	1
A201R10	107256	RN55D2002F		RESISTOR, 20K, 1/8W, 1%	1
A201R11	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
A201R12	107471	RN55D3321F		RESISTOR, 3.32K, 1/8W, 1%	1
A201R13	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
A201R14	107206	RN55D2001F		RESISTOR, 2K, 1/8W, 1%	1
A201R15	107254	RN55D1502F		RESISTOR, 15K, 1/8W, 1%	1
A201R16	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
A201R17	107179	RN55D4991F		RESISTOR, 4.99K, 1/8W, 1%	1
A201R18	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
A201R19	107471	RN55D3321F		RESISTOR, 3.32K, 1/8W, 1%	1
A201R20	102141	RN55D2432F		RESISTOR, 24.3K, 1/8W, 1%	1
A201R21	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
A201R22	107179	RN55D4991F		RESISTOR, 4.99K, 1/8W, 1%	1
A201R23	107237	RN55D1101F		RESISTOR, 1.1K, 1/8W, 1%	1
A201R24	107248	RN55D7151F		RESISTOR, 7.15K, 1/8W, 1%	1
A201R25	107277	362S502B	71450	POTENTIOMETER, 5K, 1/2W, 20%	1
A201R26	107246	RN55D5621F		RESISTOR, 5.62K, 1/8W, 1%	1
A201R27	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
A201R28	107179	RN55D4991F		RESISTOR, 4.99K, 1/8W, 1%	
A201R29	102141	RN55D2432F		RESISTOR, 24.3K, 1/8W, 1%	1
A201R30	107251	RN55D8251F		RESISTOR, 8.25K, 1/8W, 1%	1
A201R31	107246	RN55D5621F		RESISTOR, 5.62K, 1/8W, 1%	1
A201R32	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
A201R33	107247	RN55D6491F		RESISTOR, 6.49K, 1/8W, 1%	1
A201R34	107024	RN55D3741F		RESISTOR, 3.74K, 1/8W, 1%	1
A201R35	107026	RN55D5110F		RESISTOR, 511 OHM, 1/8W, 1%	1
A201R36	107259	RN55D2742F		RESISTOR, 27.4K, 1/8W, 1% (Select at Test Starting With 27.4K)	
A201R37	107519	RN55D2212F		RESISTOR, 22.1K, 1/8W, 1% (Select at Test Starting With 22.1K)	1
A201R38	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
A201R39	107024	RN55D3741F		RESISTOR, 3.74K, 1/8W, 1%	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A201R40, R41	107179	RN55D4991F		RESISTOR, 4.99K, 1/8W, 1%	2
A201R42	107471	RN55D3321F		RESISTOR, 3.32K, 1/8W, 1%	1
A201R43	107276	66WR2K	73138	POTENTIOMETER, 2K, 1/2W, 10%	1
A201R44	107225	RN55D51R1F		RESISTOR, 51.1 OHM, 1/8W, 1%	1
A201R45	107240	RN55D1621F		RESISTOR, 1.62K, 1/8W, 1%	1
A201R46	107242	RN55D2101F		RESISTOR, 2.1K, 1/8W, 1%	1
A201R47	101946	66WR200	73138	POTENTIOMETER, 200 OHM, 1/2W, 10%	1
A201R48	107243	RN55D2941F		RESISTOR, 2.94K, 1/8W, 1%	1
A201R49	107249	RN55D7501F		RESISTOR, 7.5K, 1/8W, 1%	1
A201R50	102141	RN55D2432F		RESISTOR, 24.3K, 1/8W, 1%	1
A201R51	107024	RN55D3741F		RESISTOR, 3.74K, 1/8W, 1%	1
A201R52	107260	RN55D3922F		RESISTOR, 39.2K, 1/8W, 1%	1
A201R53	107026	RN55D5110F		RESISTOR, 511 OHM, 1/8W, 1%	1
A201R54	107253	RN55D1302F		RESISTOR, 13K, 1/8W, 1%	1
A201R55	107179	RN55D4991F		RESISTOR, 4.99K, 1/8W, 1%	1
A201R56	107244	RN55D4021F		RESISTOR, 4.02K, 1/8W, 1%	1
A201R57, R58	101946	66WR200	73138	POTENTIOMETER, 200 OHM, 1/2W, 10%	2
A201R59	107550	RN55D10R0F		RESISTOR, 10 OHM, 1/8W, 1%	1
A201R60	107245	RN55D5361F		RESISTOR, 5.36K, 1/8W, 1%	1
A201R61	107549	66WR500	73138	POTENTIOMETER, 500 OHM, 1/2W, 10%	1
A201R62	107550	RN55D10R0F		RESISTOR, 10 OHM, 1/8W, 1%	1
A201R63	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
A201R65	107551	RN55D2430F		RESISTOR, 243 OHM, 1/8W, 1%	1
A201R66	107252	RN55D1212F		RESISTOR, 12.1K, 1/8W, 1%	1
A201R67	107276	66WR2K	73138	POTENTIOMETER, 2K, 1/2W, 10%	1
A201R68	107206	RN55D2001F		RESISTOR, 2K, 1/8W, 1%	1
	10920601			200 MHZ OSC & MIXER BOARD ASSY	1
	109287			SHIELD BOX ASSY	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A202	10957001			BOARD ASSY - 4TH CONVERTER Consisting of:	1
A202AR1, AR2	107323	MC1550	04713	INTEGRATED CKT	2
A202C1	100314	DM10ED330J0	02799	CAPACITOR, D MICA, 33 pf, 500V, 5%	1
A202C2	107036	DM10680J	02799	CAPACITOR, D MICA, 68 pf, 500V, 5%	1
A202C3	107304	538-011D3-15	72982	CAPACITOR, VAR, 3-15 pf	1
A202C4	107039	8131-100-651-104M	72982	CAPACITOR, C DIP, 0.1 uf, 100V, 20%	1
A202C5	107291	TG-S10	56289	CAPACITOR, C DISC, 0.01 uf, 100V, 20%	1
A202C6	107039	8131-100-651-104M	72982	CAPACITOR, C DIP, 0.1 uf, 100V, 20%	1
A202C7	107285	CK60AW102M	72982	CAPACITOR, C MOLD, 1000 pf, 1000 V, 20%	1
A202C8 thru C11	107039	8131-100-651-104M	72982	CAPACITOR, C DIP, 0.1 uf, 100V, 20%	4
A202C12	100135	538-011D9.0-35	72982	CAPACITOR, VAR, 9.0-35 pf	1
A202C13, C14	107039	8131-100-651-104M	72982	CAPACITOR, C DIP, 0.1 uf, 100V, 20%	2
A202C15	107285	CK60AW102M	72982	CAPACITOR, C MOLD, 1000 pf, 1000V, 20%	1
A202C16	107291	TG-S10	56289	CAPACITOR, C DISC, 0.01 uf, 100V, 20%	1
A202C17, C18	107039	8131-100-651-104M	72982	CAPACITOR, C DIP, 0.1 uf, 100V, 20%	2
A202C19	107417	DM-10-131J	02799	CAPACITOR, D MICA, 130 pf, 500V, 5%	1
A202C20	107304	538-011D3-15	72982	CAPACITOR, VAR, 3-15 pf	1
A202C21	107415	DM-10-300J	02799	CAPACITOR, D MICA, 30 pf, 500V, 5%	1
A202C22, C23	107309	8131-100-651-104M	72982	CAPACITOR, C DIP, 0.1 uf, 100V, 20%	2
A202C24	107138	DM-10-820J	02799	CAPACITOR, MICA, 82 pf, 500V, 5%	1
A202C25	100331	DM10ED270J0	02799	CAPACITOR, D MICA, 27 pf, 500V, 5%	1
A202C26	107304	538-011D3-15	72982	CAPACITOR, VAR, 3-15 pf	1
A202C27	107303	538-011A2-8	72982	CAPACITOR, VAR, 2-8 pf	1
A202C28, C29	107283	DM10-240J	02799	CAPACITOR, D MICA, 24 pf, 500 V, 5%	2
A202C30	107303	538-011A2-8	72982	CAPACITOR, VAR, 2-8 pf	1
A202C31	107304	538-011D3-15	72982	CAPACITOR, VAR 3-15 pf	1
A202C32	100331	DM10ED270J0	02799	CAPACITOR, D MICA, 27 pf, 500V, 5%	1
A202C33	107138	DM-10-820J	02799	CAPACITOR, D MICA, 82 pf, 500V, 5%	1
A202C34	107422	FW5N-102W	01121	CAPACITOR, FD thru, CERM DISC	1
A202C35	107600	FW5N-470W	01121	CAPACITOR, FD thru, 47 pf	1
A202C36	107291	TG-S10	56289	CAPACITOR, C DISC, 0.01 uf, 100V, 20%	1
A202C37	100234	538-011F15-60	72982	CAPACITOR, VAR, 15-60 pf	1
A202C38	107547	DM-10-620J	02799	CAPACITOR, D MICA, 62 pf, 500V, 5%	1
A202C39	107291	TG-S10	56289	CAPACITOR, C DISC, 0.01 uf, 100V, 20%	1
A202C40 thru C43	107039	8131-100-651-104M	72982	CAPACITOR, C DIP, 0.1 uf, 100V, 20%	4
A202C44	107291	TG-S10	56289	CAPACITOR, C DISC, 0.01 uf, 100V, 20%	1
A202CR1	107042	1N914		DIODE, SIGNAL, 100V	1
A202CR2	107603	5082-3081	28480	DIODE, PIN	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A202J2	107341	52-054-0000	98291	RECPT, RF, RT ANGLE	1
A202L1	107423	1025-04	99800	INDUCTOR, FIXED, 0.22 uH, 10%	1
A202L2	107601	WEE-1.0	43543	INDUCTOR, FIXED, 1 uH, 10%	1
A202L3, L4	107423	1025-04	99800	INDUCTOR, FIXED, 0.22 uH, 10%	2
A202L5	109299			INDUCTOR ASSY	1
A202L6	101306	WEE-100	43543	INDUCTOR, FIXED, 100 uH, 5%	1
A202L7	107424	1537-30	99800	INDUCTOR, FIXED, 5.60 uH, 10%	1
A202L8	107602	WEE-220	43543	INDUCTOR, FIXED, 220 uH, 5%	1
A202L9	101306	WEE-100	43543	INDUCTOR, FIXED, 100 uH, 5%	1
A202Q1	101369	2N3646		TRANSISTOR, SIN PN	1
A202Q2	102696	2N3563		TRANSISTOR, SIN PN	1
A202R1	107454	RN55D20R0F		RESISTOR, MF, 20 OHM, 1/8W, 1%	1
A202R2	107206	RN55D2001F		RESISTOR, MF, 2K, 1/8W, 1%	1
A202R3	107229	RN55D1000F		RESISTOR, MF, 100 OHM, 1/8W, 1%	1
A202R4	107026	RN55D5110F		RESISTOR, MF, 511 OHM, 1/8W, 1%	1
A202R5	107454	RN55D20R0F		RESISTOR, MF, 20 OHM, 1/8W, 1%	1
A202R6	101552	RC07GF153J		RESISTOR, CC, 1/4W, 15K, 5%	1
A202R7	107236	RN55D8660F		RESISTOR, MF, 866 OHM, 1/8W, 1%	1
A202R8	107229	RN55D1000F		RESISTOR, MF, 100 OHM, 1/8W, 1%	1
A202R9	107249	RN55D7501F		RESISTOR, MF, 7.5K, 1/8W, 1%	1
A202R10	107421	RN55D5111F		RESISTOR, MF, 5.11K, 1/8W, 1%	1
A202R11	107016	RN55D1001F		RESISTOR, MF, 1K, 1/8W, 1%	1
A202R12	107599	RN55D6190F		RESISTOR, MF, 619 OHM, 1/8W, 1%	1
A202R14	107017	RN55D1002F		RESISTOR, MF, 10K, 1/8W, 1%	1
A202R15	107229	RN55D1000F		RESISTOR, MF, 100 OHM, 1/8W, 1%	1
A202R16	107017	RN55D1002F		RESISTOR, MF, 10K, 1/8W, 1%	1
A202R17	107232	RN55D2000F		RESISTOR, MF, 200 OHM, 1/8W, 1%	1
A202R18	101810	RC05GF270J		RESISTOR, CC, 27 OHM, 1/8W, 5%	1
A202R19	107016	RN55D1001F		RESISTOR, MF, 1K, 1/8W, 1%	1
A202VR1	107414	1N753		DIODE, REF, 6.2V, 10%	1
	10957801			BOARD ASSEMBLY - L.O. & MIXER	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A203	10948701			BOARD ASSY - 100 KHZ B.P. FILTER Consisting of:	1
A203AR1	107323	MC1550G	04713	INTEGRATED CKT	1
A203C1, C2	107039	8183-100-651-104M	72982	CAPACITOR, .1 uf, 100V	2
A203C6 thru C11	107291	TG-S10	56289	CAPACITOR, .01 uf, 50V	6
A203C12	107289	DM10-221J	02799	CAPACITOR, 220 pf, 500V, 5%	1
A203C13	100234	538-011F-15-60	72982	CAPACITOR, VAR, 15-60 pf	1
A203C14	107289	DM10-221J	02799	CAPACITOR, 220 pf, 500V, 5%	1
A203C15	100234	538-011F-15-60	72982	CAPACITOR, VAR, 15-60 pf	1
A203C16	107289	DM10-221J	02799	CAPACITOR, 220 pf, 500V, 5%	1
A203C17	100234	538-011F-15-60	72982	CAPACITOR, VAR, 15-60 pf	1
A203C18	107289	DM10-221J	02799	CAPACITOR, 220 pf, 500V, 5%	1
A203C19	100234	438-011F-15-50	72982	CAPACITOR, VAR, 15-60 pf	1
A203C20 thru C24	107291	TG-S10	56289	CAPACITOR, .01 uf, 50V	5
A203C25	107039	8131-100-651-104M	72982	CAPACITOR, .1 uf, 100V	1
A203C26, C27	107291	TG-S10	56289	CAPACITOR, .01 uf, 50V	2
A203C28 thru C30	107278	DM10-030D	02799	CAPACITOR, 3 pf, 500V	3
A203C31	107291	TG-S10	56289	CAPACITOR, .01 uf, 50V	1
A203C32	100203	CS13BE225K		CAPACITOR, 2.2 uf, 20V	1
A203C33, C34	107291	TG-S10	56289	CAPACITOR, .01 uf, 50V	2
A203C35	107039	8131-100-651-104M	72982	CAPACITOR, .1 uf, 100V	1
A203CR1 thru CR6	107042	1N914		DIODE	6
A203L1 thru L3	101297	WEE-470	43543	INDUCTOR, 470 uH	3
A203L4 thru L7	109051			INDUCTOR, VAR, 1.9 - 2.3 uH	4
A203L8, L9	101297	WEE-470	43543	INDUCTOR, 470 uH	2
A203Q1 thru Q3	102696	2N3563		TRANSISTOR	3
A203R4	101588	RC07GF241J		RESISTOR, 240 OHM, 1/4W, 5%	1
A203R5	101607	RC07GF203J		RESISTOR, 20K, 1/4W, 5%	1
A203R6	101541	RC07GF512J		RESISTOR, 5.1K, 1/4W, 5%	1
A203R7	101570	RC07GF103J		RESISTOR, 10K, 1/4W, 5%	1
A203R8	101607	RC07GF203J		RESISTOR, 20K, 1/4W, 5%	1
A203R9, R10	101570	RC07GF103J		RESISTOR, 10K, 1/4W, 5%	2
A203R11	101754	RC07GF113J		RESISTOR, 11K, 1/4W, 5%	1
A203R12	101569	RC07GF102J		RESISTOR, 1K, 1/4W, 5%	1
A203R13	107268	3359P1-102	80294	RESISTOR, VAR, 1K	1
A203R14	101602	RC07GF182J		RESISTOR, 1.8K, 1/4W, 5%	1
A203R15	101609	RC07GF101J		RESISTOR, 100 OHM, 1/4W, 5%	1
A203R16	101572	RC07GF223J		RESISTOR, 22K, 1/4W, 5%	1
A203R17	101609	RC07GF101J		RESISTOR, 100 OHM, 1/4W, 5%	1
A203R18	101572	RC07GF223J		RESISTOR, 22K, 1/4W, 5%	1
A203R19	101602	RC07GF182J		RESISTOR, 1.8K, 1/4W, 5%	1
A203R20	101570	RC07GF103J		RESISTOR, 10K, 1/4W, 5%	1
A203R21	101552	RC07GF153J		RESISTOR, 15K, 1/4W, 5%	1
A203R22	101745	RC07GF361J		RESISTOR, 360 OHM, 1/4W, 5%	1
A203R23	101609	RC07GF101J		RESISTOR, 100 OHM, 1/4W, 5%	1
A203R24, R25	101570	RC07GF103J		RESISTOR, 10K, 1/4W, 5%	2
A203R26	107410	RC07GF110J		RESISTOR, 11 OHM, 1/4W, 5%	1
A203R27	101602	RC07GF182J		RESISTOR, 1.8K, 1/4W, 5%	1
A203R28	101672	RC07GF510J		RESISTOR, 51 OHM, 1/4W, 5%	1
A203R29	101609	RC07GF101J		RESISTOR, 100 OHM, 1/4W, 5%	1
A203R30	101940	RC07GF200J		RESISTOR, 20 OHM, 1/4W, 5%	1
A203R31	101598	RC07GF472J		RESISTOR, 4.7K, 1/4W, 5%	1
A203R32	107009	362Y103B	11236	POTENTIOMETER, 1T, 10K, 20%	1
A203R33	101584	RC07GF562J		RESISTOR, 5.6K, 1/4W, 5%	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A204	10948801			BOARD ASSY - 6.5 MHZ XTAL FILTER B Consisting of:	
A204C1	100203	150D225X9020A2	56289	CAPACITOR, TANT, 2.2 uf, 20V, 10%	1
A204C2 thru C6	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	5
A204C8	100252	DM10-101J	02799	CAPACITOR, D MICA, 100 pf	1
A204C10 thru C15	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	6
A204C17, C18 C19	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	3
A204C20	107303	538-011A-2-8	72982	CAPACITOR, VAR, 2-8 pf	1
A204C21	107304	538-011D-3-15	72982	CAPACITOR, VAR, 3-15 pf	1
A204C22	107033	DM5050D		CAPACITOR, D MICA, 5 pf, 300V, 0.5%	1
A204C23, C24	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	2
A204C26	100252	DM10-101J	02799	CAPACITOR, D MICA, 100 pf	1
A204C27 thru C30	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	4
A204C31	107303	538-011A-2-8	72982	CAPACITOR, VAR, 2-8 pf	1
A204C32	107304	538-011D-3-15	72982	CAPACITOR, VAR, 3-15 pf	1
A204C33, C34	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	2
A204C35	107033	DM5050D		CAPACITOR, D MICA, 5 pf, 300V, 0.5%	1
A204C36, C37	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	2
A204C39	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	1
A204C40	107033	DM5050D		CAPACITOR, D MICA, 5 pf, 300V, 0.5%	1
A204C41, C42	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	2
A204C43	107288	DM10-111J	02799	CAPACITOR, D MICA, 110 pf	1
A204C44 thru C47	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	4
A204C48	107303	538-011A-2-8	72982	CAPACITOR, VAR, 2-8 pf	1
A204C49	107304	538-011D-3-15	72982	CAPACITOR, VAR, 3-15 pf	1
A204C50, C51, C52	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	3
A204C54, C55, C57, C58	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	4
A204C59	107282	DM10-220J	02799	CAPACITOR, D MICA, 22 pf	1
A204C60	107281	DM10-200J	02799	CAPACITOR, D MICA, 20 pf	1
A204C61	100272	DM10-100J	02799	CAPACITOR, D MICA, 10 pf	1
A204C62	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	1
A204C63	100203	150D225X9020A2	56289	CAPACITOR, TANT, 2.2 uf, 20V 10%	1
A204C64 thru C67	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	4
A204C70 thru C75	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	6
A204CR1 thru CR5	107042	1N914		DIODE, SIGNAL, 100V	5
A204CR7, CR8, CR9	107042	1N914		DIODE, SIGNAL, 100V	3
A204CR11, CR12, CR13	107042	1N914		DIODE, SIGNAL, 100V	3
A204CR15 thru CR21	107042	1N914		DIODE, SIGNAL, 100V	7
A204L1 thru L4	101297	WEE-470	43543	INDUCTOR, FIXED, 470 uH	4

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A204L5	107325	WEE-4.7	43543	INDUCTOR, FIXED, 4.7 uH	1
A204L6	109589			INDUCTOR, VAR	1
A204L7	101306	WEE-100	43543	INDUCTOR, FIXED, 100 uH	1
A204L8, L9	109589			INDUCTOR, VAR	2
A204L10	101306	WEE-100	43543	INDUCTOR, FIXED, 100 uH	1
A204L11	107328	1025-54	99800	INDUCTOR, FIXED, 27 uH	1
A204L12	101297	WEE-470	43543	INDUCTOR, FIXED, 470 uH	1
A204L13, L14	107325	WEE-4.7	43543	INDUCTOR, FIXED, 4.7 uH	2
A204L15	101306	WEE-100	43543	INDUCTOR, FIXED, 100 uH	1
A204Q1, Q2	107011	2N3641		TRANSISTOR	2
A204Q3	109542			TRANSISTOR	1
A204Q4	107011	2N3641		TRANSISTOR	1
A204Q5	109542			TRANSISTOR	1
A204Q6, Q7	107011	2N3641		TRANSISTOR	2
A204Q8	109542			TRANSISTOR	1
A204Q9, Q10	107011	2N3641		TRANSISTOR	2
A204Q11	107316	2N3638A		TRANSISTOR	1
A204Q12, Q13	107011	2N3641		TRANSISTOR	2
A204R1	101565	RC07GF123J		RESISTOR, CC, 12K, 1/4W, 5%	1
A204R3	101541	RC07GF512J		RESISTOR, CC, 5.1K, 1/4W, 5%	1
A204R4	101570	RC07GF103J		RESISTOR, CC, 10K, 1/4W, 5%	1
A204R5	101670	RC07GF203J		RESISTOR, CC, 20K, 1/4W, 5%	1
A204R6	101664	RC07GF111J		RESISTOR, CC, 110 OHM, 1/4W, 5%	1
A204R7	101569	RC07GF102J		RESISTOR, CC, 1K, 1/4W, 5%	1
A204R8	101754	RC07GF113J		RESISTOR, CC, 11K, 1/4W, 5%	1
A204R9	101565	RC07GF123J		RESISTOR, CC, 12K, 1/4W, 5%	1
A204R10	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A204R11	101774	RC07GF431J		RESISTOR, CC, 430 OHM, 1/4W, 5%	1
A204R12	101559	RC07GF332J		RESISTOR, CC, 3.3K, 1/4W, 5%	1
A204R13	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A204R14	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A204R15	107582	RN55D90R9F		RESISTOR, MF, 90.9 OHM, 1/8W, 1%	1
A204R16	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A204R17	107457	RN55D3320F		RESISTOR, MF, 332 OHM, 1/8W, 1%	1
A204R20	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A204R21	107470	RN55D1431F		RESISTOR, MF, 1.43K, 1/8W, 1%	1
A204R22	101669	RC07GF681J		RESISTOR, CC, 680 OHM, 1/4W 5%	1
A204R23	101542	RC07GF271J		RESISTOR, CC, 270 OHM, 1/4W, 5%	1
A204R24	101668	RC07GF181J		RESISTOR, CC, 180 OHM, 1/4W, 5%	1
A204R25	101581	RC07GF122J		RESISTOR, CC, 1.2K, 1/4W, 5%	1
A204R26	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A204R27	101577	RC07GF152J		RESISTOR, CC, 1.5K, 1/4W, 5%	1
A204R28	101754	RC07GF113J		RESISTOR, CC, 11K, 1/4W, 5%	1
A204R29	101664	RC07GF111J		RESISTOR, CC, 110 OHM, 1/4W, 5%	1
A204R30	101565	RC07GF123J		RESISTOR, CC, 12K, 1/4W, 5%	1
A204R31	101569	RC07GF102J		RESISTOR, CC, 1K, 1/4W, 5%	1
A204R32	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W 5%	1
A204R33	101559	RC07GF332J		RESISTOR, CC, 3.3K, 1/4W, 5%	1
A204R34	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A204R35	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A204R36	107582	RN55D90R9F		RESISTOR, MF, 90.9 OHM, 1/8W, 1%	1
A204R37	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A204R38	107457	RN55D3320F		RESISTOR, MF, 332 OHM, 1/8W, 1%	1
A204R41	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A204R42	107470	RN55D1431F		RESISTOR, MF, 1.43K, 1/8W, 1%	1
A204R43	101669	RC07GF681J		RESISTOR, CC, 680 OHM, 1/4W, 5%	1
A204R44	101542	RC07GF271J		RESISTOR, CC, 270 OHM, 1/4W, 5%	1
A204R45	101668	RC07GF181J		RESISTOR, CC, 180 OHM, 1/4W, 5%	1
A204R46	101581	RC07GF122J		RESISTOR, CC, 1.2K, 1/4W, 5%	1
A204R47	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A204R48	101577	RC07GF152J		RESISTOR, CC, 1.5K, 1/4W, 5%	1
A204R49	101664	RC07GF111J		RESISTOR, CC, 110 OHM, 1/4W, 5%	1
A204R50	101754	RC07GF113J		RESISTOR, CC, 11K, 1/4W, 5%	1
A204R51	101569	RC07GF102J		RESISTOR, CC, 1K, 1/4W, 5%	1
A204R52	101565	RC07GF123J		RESISTOR, CC, 12K, 1/4W, 5%	1
A204R53	101774	RC07GF431J		RESISTOR, CC, 430 OHM, 1/4W, 5%	1
A204R54	101559	RC07GF332J		RESISTOR, CC, 3.3K, 1/4W, 5%	1
A204R55, R56	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	2
A204R57	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A204R58	107582	RN55D90R9F		RESISTOR, MF, 90.9 OHM, 1/8W, 1%	1
A204R59	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A204R60	107457	RN55D3320F		RESISTOR, MF, 332 OHM, 1/8W, 1%	1
A204R63	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A204R64	107470	RN55D1431F		RESISTOR, MF, 1.43K, 1/8W, 1%	1
A204R65	101669	RC07GF681J		RESISTOR, CC, 680 OHM, 1/4W, 5%	1
A204R66	101542	RC07GF271J		RESISTOR, CC, 270 OHM, 1/4W, 5%	1
A204R67	101668	RC07GF181J		RESISTOR, CC, 180 OHM, 1/4W, 5%	1
A204R68	101581	RC07GF122J		RESISTOR, CC, 1.2K, 1/4W, 5%	1
A204R69	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A204R70	101577	RC07GF152J		RESISTOR, CC, 1.5K, 1/4W, 5%	1
A204R71	101565	RC07GF123J		RESISTOR, CC, 12K, 1/4W, 5%	1
A204R72	101593	RC07GF163J		RESISTOR, CC, 16K, 1/4W, 5%	1
A204R73	101536	RC07GF331J		RESISTOR, CC, 330 OHM, 1/4W, 5%	1
A204R74	101557	RC07GF100J		RESISTOR, CC, 10 OHM, 1/4W, 5%	1
A204R75	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A204R76	101562	RC07GF222J		RESISTOR, CC, 2.2K, 1/4W, 5%	1
A204R77	101574	RC07GF473J		RESISTOR, CC, 47K, 1/4W, 5%	1
A204R78	101570	RC07GF103J		RESISTOR, CC, 10K, 1/4W, 5%	1
A204R79	101569	RC07GF102J		RESISTOR, CC, 1K, 1/4W, 5%	1
A204R80	101745	RC07GF361J		RESISTOR, CC, 360 OHM, 1/4W, 5%	1
A204R81	101672	RC07GF510J		RESISTOR, CC, 51 OHM, 1/4W, 5%	1
A204R82	101588	RC07GF241J		RESISTOR, CC, 240 OHM, 1/4W, 5%	1
A204R83	101567	RC07GF821J		RESISTOR, CC, 820 OHM, 1/4W, 5%	1
A204R86, R87	107030	362Y501B	71450	POTENTIOMETER, IT, PC, 500 OHM	2
A204R89	101626	RC07GF242J		RESISTOR, CC, 2.4K, 1/4W, 5%	1
A204R90	101562	RC07GF222J		RESISTOR, CC, 2.2K, 1/4W, 5%	1
A204R93	107028	3624102B	71450	POTENTIOMETER, 1T, PC, 1K	1
A204R94	101541	RC07GF512J		RESISTOR, CC, 5.1K, 1/4W, 5%	1
A204R95, R96 R97	107025	RN55D4322F		RESISTOR, MF, 43.2K, 1/8W, 1%	3
A204R98	101774	RC07GF431J		RESISTOR, CC, 430 OHM, 1/4W, 5%	1
A204R99	107031	362Y502B	71450	POTENTIOMETER, 1T, PC, 5K	1
A204R100	101562	RC07GF222		RESISTOR, CC, 2.2K, 1/4W, 5%	1
A204TP1 thru TP6, GND	107583	2520B-1	88245	PIN, PC	6
A204TP7 thru TP12	107121	85931-6	89110	PIN, PC	6
A204X1 thru X3	107346	8000-AG36	91506	CRYSTAL HOLDER	3
A204Y1 thru Y3	109043			CRYSTAL, 6.5 MHz (Set consists of 3 crystals as matched set)	1 Set

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A205	10913701			BOARD ASSY - LIN-LOG AMPLIFIER Consisting of:	1
A205AR1	107467	U5F7715393	07263	INTEGRATED CKT	1
A205C1	107039	8131-100-651-104M	72982	CAPACITOR, 1.0 uf, 100V, 20%	1
A205C2	100252	DM10-101J	02799	CAPACITOR, 100 pf, 500V, 5%	1
A205C3	107462	CD15FA102G03	14655	CAPACITOR, 1000 pf, 100V, 2%	1
A205C4	107039	8131-100-651-104M	72982	CAPACITOR, 1.0 uf, 100V, 20%	1
A205C5	107291	TG-S10	56289	CAPACITOR, 0.01 uf, 100V, 20%	1
A205C6	107289	DM10-221J	02799	CAPACITOR, 220 pf, 500V, 5%	1
A205C7	107464	DM10-120J	02799	CAPACITOR, 12 pf, 500V, 5%	1
A205C8	107286	DM10-750J	02799	CAPACITOR, 75 pf, 500V, 5%	1
A205C9	107289	DM10-221J	02799	CAPACITOR, 220 pf, 500V, 5%	1
A205C10	107291	TG-S10	56289	CAPACITOR, 0.01 uf, 100V, 20%	1
A205C11	107462	CD15FA102G03	14655	CAPACITOR, 1000 pf, 100V, 2%	1
A205C12, C13	107039	8131-100-651-104M	72982	CAPACITOR, 1.0 uf, 100V, 20%	2
A205C14	107462	CD15FA102G03	14655	CAPACITOR, 1000 pf, 100V, 2%	1
A205C15	107291	TG-S10	56289	CAPACITOR, 0.01 uf, 100V, 20%	1
A205C16	107286	DM10-750J	02799	CAPACITOR, 75 pf, 500V, 5%	1
A205C17	107289	DM10-221J	02799	CAPACITOR, 220 pf, 500V, 5%	1
A205C18, C19	107283	DM10-240J	02799	CAPACITOR, 24 pf, 500V, 5%	2
A205C20	107286	DM10-750J	02799	CAPACITOR, 75 pf, 500V, 5%	1
A205C21	107039	8131-100-651-104M	72982	CAPACITOR, 1.0 uf, 100V, 20%	1
A205C22	107291	TG-S10	56289	CAPACITOR, 0.01 uf, 100V, 20%	1
A205C23	107462	CD15FA102G03	14655	CAPACITOR, 1000 pf, 100V, 2%	1
A205C24, C25	107039	8131-100-651-104M	72982	CAPACITOR, 1.0 uf, 100V, 20%	2
A205C26	107289	DM10-221J	02799	CAPACITOR, 220 pf, 500V, 5%	1
A205C27	100252	DM10-101J	02799	CAPACITOR, 100 pf, 500V, 5%	1
A205C28	107289	DM10-221J	02799	CAPACITOR, 220 pf, 500V, 5%	1
A205C29	107462	CD15FA102G03	14655	CAPACITOR, 1000 pf, 100V, 2%	1
A205C30, C31	107283	DM10-240J	02799	CAPACITOR, 24 pf, 500V, 5%	2
A205C32	100252	DM100-101J	02799	CAPACITOR, 100 pf, 500V, 5%	1
A205C33	107291	TG-S10	56289	CAPACITOR, 0.01 uf, 100V, 20%	1
A205C34, C35	107039	8131-100-651-104M	72982	CAPACITOR, 1.0 uf, 100V, 20%	2
A205C36	107462	CD15FA102G03	14655	CAPACITOR, 1000 pf, 100V, 2%	1
A205C37	107289	DM10-221J	02799	CAPACITOR, 220 pf, 500V, 5%	1
A205C38	107283	DM10-240J	02799	CAPACITOR, 24 pf, 500V, 5%	1
A205C39	107464	DM10-120J	02799	CAPACITOR, 12 pf, 500V, 5%	1
A205C40	107039	8131-100-651-104M	72982	CAPACITOR, 1.0 uf, 100V, 20%	1
A205C41	107291	TG-S10	56289	CAPACITOR, 0.01 uf, 100V, 20%	1
A205C42	10739	8131-100-651-104M	72982	CAPACITOR, 1.0 uf, 100V, 20%	1
A205C43	107291	TG-S10	56289	CAPACITOR, 0.01 uf, 100V, 20%	1
A205C44	100135	538-011D-9-35	72932	CAPACITOR, VAR 9-35 pf	1
A205C45	107039	8131-100-651-104M	72982	CAPACITOR, 1.0 uf, 100V, 20%	1
A205C46, C47	107291	TG-S10	56289	CAPACITOR, 0.01 uf, 100V, 20%	2
A205C48, C48	100252	DM10-101J	02799	CAPACITOR, 100 pf, 500V, 5%	2
A205C50 thru C52	107039	8131-100-651-104M	72982	CAPACITOR, 1.0 uf, 100V, 20%	3
A205C53	100252	DM10-101J	02799	CAPACITOR, 100 pf, 500V, 5%	1
A205C54	107465	5GA-T47	56289	CAPACITOR, 470 pf, 1KV, 20%	1
A205C55	107294	5GA-D10	56289	CAPACITOR, 1000 pf, 1KV, 20%	1
A205C56	107039	8131-100-651-104M	72982	CAPACITOR, 1.0 uf, 100V, 20%	1
A205C57	107463	DM10-020D	07299	CAPACITOR, 2 pf, 500V, 0.5%	1
A205CR1 thru CR11	107042	1N914		DIODE	11
A205CR12	100442	5082-2800	28480	DIODE	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A205L1	107424	1537-30	99800	INDUCTOR, 5.6 uH	1
A205L2	107328	1025-54	99800	INDUCTOR, 27 uH	1
A205L3	107424	1537-30	99800	INDUCTOR, 5.6 uH	1
A205L4, L5	101306	WEE-100	43543	INDUCTOR, 100 uH	2
A205L6	107424	1537-30	99800	INDUCTOR, 5.6 uH	1
A205L7, L8	107328	1025-54	99800	INDUCTOR, 27 uH	2
A205L9	107424	1537-30	99800	INDUCTOR, 5.6 uH	1
A205L10, L11	101306	WEE-100	43543	INDUCTOR, 100 uH	2
A205L12	107424	1537-30	99800	INDUCTOR, 5.6 uH	1
A205L13, L14	107328	1025-54	99800	INDUCTOR, 27 uH	2
A205L15	107424	1537-30	99800	INDUCTOR, 5.6 uH	1
A205L16, L17	101306	WEE-100	43543	INDUCTOR, 100 uH	2
A205L18	107328	1025-54	99800	INDUCTOR, 27 uH	1
A205L19	101306	WEE-100	43543	INDUCTOR, 100 uH	1
A205L20	107466	WEE-10	43543	INDUCTOR, 10 uH	1
A205L21, L22	101306	WEE-100	43543	INDUCTOR, 100 uH	2
A205Q1 thru Q6	107468	2N3646		TRANSISTOR (BETA 75 to 100)	6
A205Q7	107011	2N3641		TRANSISTOR	1
A205R1	107240	RN55D1621F		RESISTOR, 1.62K, 1/8W, 1% (NOMINAL)	1
A205R2	107238	RN55D1241F		RESISTOR, 1.24K, 1/8W, 1% (SELECT)	
A205R2	107206	RN55D2001F		RESISTOR, 2.00K, 1/8W, 1% (SELECT)	
A205R2	107239	RN55D1331F		RESISTOR, 1.33K, 1/8W, 1%	1
A205R3	107457	RN55D3320F		RESISTOR, 332 OHM, 1/8W, 1%	1
A205R4	107421	RN55D5111F		RESISTOR, 5.11K, 1/8W, 1%	1
A205R5	107455	RN55D22R1F		RESISTOR, 22.1 OHM, 1/8W, 1%	1
A205R6	107019	RN55D1501F		RESISTOR, 1.5K, 1/8W, 1%	1
A205R7	107458	RN55D3920F		RESISTOR, 392 OHM, 1/8W, 1%	1
A205R8	107016	RN55D1001F		RESISTOR, 1000 OHM, 1/8W, 1%	1
A205R9	107460	RN55D6811F		RESISTOR, 6.81K, 1/8W, 1%	1
A205R10	107239	RN55D1331F		RESISTOR, 1.33K, 1/8W, 1%	1
A205R11	107457	RN55D3320F		RESISTOR, 332 OHM, 1/8W, 1%	1
A205R12	107421	RN55D5111F		RESISTOR, 5.11K, 1/8W, 1%	1
A205R13	197456	RN55D33R2F		RESISTOR, 33.2 OHM, 1/8W, 1%	1
A205R14	107019	RN55D1501F		RESISTOR, 1.5K, 1/8W, 1%	1
A205R15	107458	RN55D3920F		RESISTOR, 392 OHM, 1/8W, 1%	1
A205R16	107460	RN55D6811F		RESISTOR, 6.81K, 1/8W, 1%	1
A205R17	107457	RN55D3320F		RESISTOR, 332 OHM, 1/8W, 1%	1
A205R18	107239	RN55D1331F		RESISTOR, 1.33K, 1/8W, 1%	1
A205R19	107421	RN55D5111F		RESISTOR, 5.11K, 1/8W, 1%	1
A205R20	107224	RN55D30R1F		RESISTOR, 30.1 OHM, 1/8W, 1%	1
A205R21	107019	RN55D1501F		RESISTOR, 1.5K, 1/8W, 1%	1
A205R22	107458	RN55D3920F		RESISTOR, 392 OHM, 1/8W, 1%	1
A205R23	107249	RN55D7501F		RESISTOR, 7.5K, 1/8W, 5%	1
A205R24	107026	RN55D5110F		RESISTOR, 511 OHM, 1/8W, 1%	1
A205R25	107239	RN55D1331F		RESISTOR, 1.33K, 1/8W, 1%	1
A205R26	107421	RN55D5111F		RESISTOR, 5.11K, 1/8W, 1%	1
A205R27	107225	RN55D51R1F		RESISTOR, 51.1 OHM, 1/8W, 1%	1
A205R28	107019	RN55D1501F		RESISTOR, 1.5K, 1/8W, 1%	1
A205R29	107458	RN55D3920F		RESISTOR, 392 OHM, 1/8W, 1%	1
A205R30	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
A205R31	107457	RN55D3320F		RESISTOR, 332 OHM, 1/8W, 1%	1
A205R32	107239	RN55D1331F		RESISTOR, 1.33K, 1/8W, 1%	1
A205R33	107421	RN55D5111F		RESISTOR, 5.11K, 1/8W, 1%	1
A205R34	107455	RN55D22R1F		RESISTOR, 22.1 OHM, 1/8W, 1%	1
A205R35	107019	RN55D1501F		RESISTOR, 1.5K, 1/8W, 1%	1
A205R36	107016	RN55D1001F		RESISTOR, 1000 OHM, 1/8W, 1%	1
A205R37	107460	RN55D6811F		RESISTOR, 6.81K, 1/8W, 1%	1
A205R38	107458	RN55D3920F		RESISTOR, 392 OHM, 1/8W, 1%	1
A205R39	197239	RN55D1331F		RESISTOR, 1.33K, 1/8W, 1%	1
A205R40	107421	RN55D5111F		RESISTOR, 5.11K, 1/8W, 1%	1
A205R41	107019	RN55D1501F		RESISTOR, 1.5K, 1/8W, 1%	1
A205R42	107454	RN55D20R0F		RESISTOR, 20 OHM, 1/8W, 1% (NOMINAL)	1
A205R42	107223	RN55D17R8F		RESISTOR, 17.8 OHM, 1/8W, 1% (SELECT)	

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A205R42	107445	RN55222R1F		RESISTOR, 22.1 OHM, 1/8W, 1% (SELECT)	
A205R43	107457	RN55D3320F		RESISTOR, 332 OHM, 1/8W, 1%	1
A205R44	107249	RN55D7501F		RESISTOR, 7.5K, 1/8W, 5%	1
A205R45	107271	79PR102	73138	POTENTIOMETER, 1K, 0.75W	1
A205R46	107016	RN55D1001F		RESISTOR, 1000 OHM, 1/8W, 1%	1
A205R47, R48	107421	RN55D5111F		RESISTOR, 5.11K, 1/8W, 1%	2
A205R49	107239	RN55D1331F		RESISTOR, 1.33K, 1/8W, 1%	1
A205R50	107421	RN55D5111F		RESISTOR, 5.11K, 1/8W, 1%	1
A205R51	107016	RN55D1001F		RESISTOR, 1000 OHM, 1/8W, 1%	1
A205R52	107226	RN55D60R4F		RESISTOR, 60.4 OHM, 1/8W, 1%	1
A205R53	107026	RN55D5110F		RESISTOR, 511 OHM, 1/8W, 1%	1
A205R54, R55	107459	RN55D2431F		RESISTOR, 2.43K, 1/8W, 1%	2
A205R56	107206	RN55D2001F		RESISTOR, 2K, 1/8W, 1%	1
A205R57	107271	79PR102	73138	POTENTIOMETER, 1K, 0.75W	1
A205R58	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
A205R59	107250	RN55D8062F		RESISTOR, 8.06K, 1/8W, 1%	1
A205R60	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
A205R61	107018	RN55D1003F		RESISTOR, 100K, 1/8W, 1%	1
A205R62	107270	79PR500	73138	TRIMPOT, 500 OHM	1
A205R63	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
A205R64, R65	107229	RN55D1000F		RESISTOR, 100 OHM, 1/8W, 1%	2
A205R66	107461	RN60D1783F		RESISTOR, 178K, 1/8W, 1%	1
A205R67	107229	RN55D1000F		RESISTOR, 100 OHM, 1/8W, 1%	1
A205R68	107458	RN55D3920F		RESISTOR, 392 OHM, 1/8W, 1%	1
A205TP1 thru TP8	107413	180-7336-02-05	71279	TERMINAL	8

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A206	10916301			BOARD ASSY - HARMONIC ATTENUATOR & VIDEO FILTER Consisting of:	1
A206AR1, AR2	107054	741TC	07263	INTEGRATED CKT, OP AMP, 8 LEAD, MINIDIP	2
A206AR3	107562	LM310H	27014	INTEGRATED CKT, OP AMP, 8 PIN, METAL CAN	1
A206AR4	107054	741TC	07263	INTEGRATED CKT, OP AMP, 8 LEAD, MINIDIP	1
A206C1	107291	TG-S10	56289	CAPACITOR, C DISC, 0.01 uf, 100V, 20%	1
A206C2	107287	5C023474X025DB3	56289	CAPACITOR, C MOLD, 0.47 uf, 25V, 20%	1
A206C3	107293	TG-D50	56289	CAPACITOR, C DISC, 0.005 uf, 100V, 20%	1
A206C7	100203	CS13BE225K	56289	CAPACITOR, TANT, 2.2 uf, 20V, 10%	1
A206C8	107291	TG-S10	56289	CAPACITOR, C DISC, 0.01 uf, 100V, 20%	1
A206CR1 thru CR6	107042	1N914		DIODE, SIGNAL, 100V	6
A206CR7	100442	5082-2800	28480	DIODE, SIGNAL, 70V, 100 ps	1
A206CR8 thru CR19	107042	1N914		DIODE, SIGNAL, 100V	12
A206CR20 thru CR24	100442	5082-2800	28480	DIODE, SIGNAL, 70V, 100 ps	5
A206CR25 thru CR27	107042	1N914		DIODE, SIGNAL, 100V	3
A206J1	107342	3429-1002	75037	CONNECTOR, PC, 26 PIN, RT ANGLE	1
A206K1	107170	1C15AH	21317	RELAY, REED, 15V, 1500 OHM	1
A206L1	101297	WEE-470	43543	INDUCTOR, FIXED, 470 uH, 5%	1
A206Q1 thru Q6	107316	2N3638A		TRANSISTOR, SIPNP	6
A206Q7 thru Q9	107011	2N3641		TRANSISTOR, SINPN	3
A206Q12, Q13	107316	2N3638A		TRANSISTOR, SIPNP	2
A206Q10	101369	2N3646		TRANSISTOR, SINPN	1
A206R1	107017	RN55D1002F		RESISTOR, MF, 10K, 1/8W, 1%	1
A206R2	107021	RN55D3011F		RESISTOR, MF, 3.01K, 1/8W, 1%	1
A206R3	107270	79PR500		POTENTIOMETER, 15T, PC, 500 OHM, 10%	1
A206R4	107021	RN55D3011F		RESISTOR, MF, 3.01K, 1/8W, 1%	1
A206R5	101549	RC07GF303J		RESISTOR, CC, 30K, 1/4W, 5%	1
A206R6	101548	RC07GF302J		RESISTOR, CC, 3K, 1/4W, 5%	1
A206R7	101552	RC07GF153J		RESISTOR, CC, 15K, 1/4W, 5%	1
A206R8	101549	RC07GF303J		RESISTOR, CC, 30K, 1/4W, 5%	1
A206R9	107017	RN55D1002F		RESISTOR, MF, 10K, 1/8W, 1%	1
A206R10	107179	RN55D4991F		RESISTOR, MF, 4.99K, 1/8W, 1%	1
A206R11	101552	RC07GF153J		RESISTOR, CC, 15K, 1/4W, 5%	1
A206R12	101549	RC07GF303J		RESISTOR, CC, 30K, 1/4W, 5%	1
A206R13	107471	RN55D3321F		RESISTOR, MF, 3.32K, 1/8W, 1%	1
A206R14	101552	RC07GF153J		RESISTOR, CC, 15K, 1/4W, 5%	1
A206R15	101549	RC07GF303J		RESISTOR, CC, 30K, 1/4W, 5%	1
A206R16	107206	RN55D2001F		RESISTOR, MF, 2K, 1/8W, 1%	1
A206R17	101552	RC07GF153J		RESISTOR, CC, 15K, 1/4W, 5%	1
A206R18	101549	RC07GF303J		RESISTOR, CC, 30K, 1/4W, 5%	1
A206R19	107237	RN55D1101F		RESISTOR, MF, 1.1K, 1/8W, 1%	1
A206R20	101552	RC07GF153J		RESISTOR, CC, 15K, 1/4W, 5%	1
A206R21	101549	RC07GF303J		RESISTOR, CC, 30K, 1/4W, 5%	1
A206R22	101552	RC07GF153J		RESISTOR, CC, 15K, 1/4W, 5%	1
A206R23	101549	RC07GF303J		RESISTOR, CC, 30K, 1/4W, 5%	1
A206R24	107017	RN55D1002F		RESISTOR, MF, 10K, 1/8W, 1%	1
A206R25	107537	RN55D4751F		RESISTOR, MF, 4.75K, 1/8W, 1%	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A206R26	101549	RC07GF303J		RESISTOR, CC, 30K, 1/4W, 5%	1
A206R27	107537	RN55D4751F		RESISTOR, MF, 4.75K, 1/8W, 1%	1
A206R28	101549	RC07GF303J		RESISTOR, CC, 30K, 1/4W, 5%	1
A206R29, R30	107537	RN55D4751F		RESISTOR, MF, 4.75K, 1/8W, 1%	2
A206R31	101549	RC07GF303J		RESISTOR, CC, 30K, 1/4W, 5%	1
A206R32	107537	RN55D4751F		RESISTOR, MF, 4.75K, 1/8W, 1%	1
A206R33	101596	RC07GF752J		RESISTOR, CC, 7.5K, 1/4W, 5%	1
A206R34	107561	RN55D9531F		RESISTOR, MF, 9.53K, 1/8W, 1%	1
A206R35	101549	RC07GF303J		RESISTOR, CC, 30K, 1/4W, 5%	1
A206R38	107559	RN55D1100F		RESISTOR, MF, 110 OHM, 1/8W, 1%	1
A206R39	107277	362S502B	71450	POTENTIOMETER, 1T, PC, 5K, 1/2W, 20%	1
A206R40	101754	RC07GF113J		RESISTOR, CC, 11K, 1/4W, 5%	1
A206R41	107017	RN55D1002F		RESISTOR, MF, 10K, 1/8W, 1%	1
A206R42	101688	RC07GF621J		RESISTOR, CC, 620 OHM, 1/4W, 5%	1
A206R43	107560	RN55D1211F		RESISTOR, MF, 1.21K, 1/8W, 1%	1
A206R44	101541	RC07GF512J		RESISTOR, CC, 5.1K, 1/4W, 5%	1
A206R45	107017	RN55D1002F		RESISTOR, MF, 10K, 1/8W, 1%	1
A206R46	101544	RC07GF682J		RESISTOR, CC, 6.8K, 1/4W, 5%	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A207	10953901			BOARD ASSY, 100 MHz CALIBRATOR Consisting of:	1
A207C1 thru C3	107291	TG-S10	56289	CAPACITOR, C DISC, 0.01 uf, 100V, 20%	3
A207C4	100272	DM10CD100J0	72136	CAPACITOR, D MICA, 10 pf, 500V, 5%	1
A207C5	107278	DM10-030D	72136	CAPACITOR, D MICA, 3 pf, 500V	1
A207C6, C7	107291	TG-S10	56289	CAPACITOR, C DISC, 0.01 uf, 100V, 20%	2
A207C9	100173	DM15FD101J0	72136	CAPACITOR, D MICA, 100 pf, 500V, 5%	1
A207C10	100135	538-011D	72982	CAPACITOR, VAR, 9.0 - 35 pf	1
A207C11	107291	TG-S10	56289	CAPACITOR, C DISC, 0.01 uf, 100V, 20%	1
A207C12	107289	DM10-221J	72136	CAPACITOR, D MICA, 220 pf, 500V, 5%	1
A207C13	107291	TG-S10	56289	CAPACITOR, C DISC, 0.01 uf, 100V, 20%	1
A207C14	107465	5GA-T47	56289	CAPACITOR, C DISC, 470 pf, 1000V, 20%	1
A207C15	100272	DM10CD100J0	72136	CAPACITOR, D MICA, 10 pf, 500V, 5%	1
A207C16	107291	TG-S10	56289	CAPACITOR, C DISC, 0.01 uf, 100V, 20%	1
A207C17	100173	DM15FD101J0	72136	CAPACITOR, D MICA, 100 pf, 500V, 5%	1
A207C18	100135	538-011D	72982	CAPACITOR, VAR, 9.0-35 pf	1
A207C19	100173	DM15FD101J0	72136	CAPACITOR, D MICA, 100 pf, 500V, 5%	1
A207C20, C21	107291	TG-S10	56289	CAPACITOR, C DISC, 0.01 uf, 100V 20%	2
A207C22	106496	538-014-89R	72982	CAPACITOR, VAR, 2-8 pf	1
A207CR1	107042	1N914		DIODE, SIGNAL, 100V	1
A207CR2	107605	A4S112	21847	SRD, 35 VBR 50NSMCL2	1
A207J1	107341	52-054-0000	98291	RECPT, RF, RT ANGLE	1
A207L1, L2	101306	WEE-100	43543	INDUCTOR, FIXED, 100 uH, 5%	2
A207L3	107604	1025-94	99800	INDUCTOR, FIXED, 0.1 uH, 10%	1
A207Q1, Q2	102696	2N3563		TRANSISTOR SINPN	2
A207Q3	101360	2N3638		TRANSISTOR SIPNP	1
A207Q4, Q5	102696	2N3563		TRANSISTOR SINPN	2
A207R1	101595	RC07GF822J		RESISTOR, CC, 8.2K, 1/4W, 5%	1
A207R2	101601	RC07GF392J		RESISTOR, CC, 3.9K, 1/4W, 5%	1
A207R3	101583	RC07GF561J		RESISTOR, CC, 560 OHM, 1/4W, 5%	1
A207R4	101566	RC07GF221J		RESISTOR, CC, 220 OHM, 1/4W, 5%	1
A207R5	101731	RC07GF330J		RESISTOR, 33 OHM, 1/4W, 5%	1
A207R6	101536	RC07GF331J		RESISTOR, 330 OHM, 1/4W, 5%	1
A207R7	101625	RC07GF471J		RESISTOR, CC, 470 OHM, 1/4W, 5%	1
A207R9	101566	RC07GF221J		RESISTOR, CC, 220 OHM, 1/4W, 5%	1
A207R10	101569	RC07GF102J		RESISTOR, CC, 1K, 1/4W, 5%	1
A207R11	101696	RC07GF220J		RESISTOR, CC, 22 OHM, 1/4W, 5%	1
A207R12	101569	RC07GF102J		RESISTOR, CC, 1K, 1/4W, 5%	1
A207R13	101562	RC07GF222J		RESISTOR, CC, 2.2K, 1/4W, 5%	1
A207R14	101595	RC07GF822J		RESISTOR, CC, 8.2K, 1/4W, 5%	1
A207R15	101566	RC07GF221J		RESISTOR, CC, 220 OHM, 1/4W, 5%	1
A207R16	101731	RC07GF330J		RESISTOR, 33 OHM, 1/4W, 5%	1
A207R17	101536	RC07GF331J		RESISTOR, 330 OHM, 1/4W, 5%	1
A207R18	101566	RC07GF221J		RESISTOR, CC, 220 OHM, 1/4W, 5%	1
A207R19	107608	360S102B	71450	POTENTIOMETER, 1T, PC, 1K, 1/2W, 20%	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A207R20	101559	RC07GF332J		RESISTOR, CC, 3.3K, 1/4W, 5%	1
A207R21	101557	RC07GF100J		RESISTOR, CC, 10 OHM, 1/4W, 5%	1
A207R22	101615	RC07GF151J		RESISTOR, CC, 150 OHM, 1/4W, 5%	1
A207R23	101559	RC07GF332J		RESISTOR, CC, 3.3K, 1/4W, 5%	1
A207R24	101609	RC07GF560J		RESISTOR, CC, 56 OHM, 1/4W, 5%	1
A207R25, A26	101798	RC05GF221J		RESISTOR, CC, 220 OHM, 1/8W, 5%	2
A207R27	101816	RC05GF560J		RESISTOR, CC, 56 OHM, 1/8W, 5%	1
A207R28 thru R31	101811	RC05GF330J		RESISTOR, CC, 33 OHM, 1/8W, 5%	4
A207R32	101835	RC05GF150J		RESISTOR, CC, 15 OHM, 1/8W, 5%	1
A207T1	109540			TRANSFORMER ASSY	1
A207T2	109541			TRANSFORMER ASSY	1
A207Y1	109544			CRYSTAL, 100 MHz	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A208	10948801			BOARD ASSY - 6.5 MHZ XTAL FILTER A Consisting of:	
A208C1	100203	150D225X9020A2	56289	CAPACITOR, TANT, 2.2 uf, 20V, 10%	1
A208C2 thru C6	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	5
A208C8	100252	DM10-101J	02799	CAPACITOR, D MICA, 100 pf	1
A208C10 thru C15	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	6
A208C17 thru C19	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	3
A208C20	107303	538-011A-2-8	72982	CAPACITOR, VAR, 2-8 pf	1
A208C21	107304	538-011D-3-15	72982	CAPACITOR, VAR, 3-15 pf	1
A208C22	107033	DM5050D		CAPACITOR, D MICA, 5 pf, 300V, 0.5%	1
A208C23, C24	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V 20%	2
A208C26	100252	DM10-101J	02799	CAPACITOR, D MICA, 100 pf	1
A208C27 thru C30	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V 20%	4
A208C31	107303	538-011A-2-8	72982	CAPACITOR, VAR, 2-8 pf	1
A208C32	107304	538-011D-3-15	72982	CAPACITOR, VAR, 3-15 pf	1
A208C33, C34	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	2
A208C35	107033	DM5050D		CAPACITOR, D MICA, 5 pf, 300V, 0.5%	1
A208C36, C37	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	2
A208C39	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	1
A208C40	107033	DM5050D		CAPACITOR, D MICA, 5 pf, 300V, 0.5%	1
A208C41, C42	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	2
A208C43	107288	DM10-111J	02799	CAPACITOR, D MICA, 110 pf	1
A208C44 thru C47	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	4
A208C48	107303	538-011A-2-8	72982	CAPACITOR, VAR, 2-8 pf	1
A208C49	107304	538-011D-3-15	72982	CAPACITOR, VAR, 3-15 pf	1
A208C50 thru C52	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	3
A208C54, C55, C57, C58	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	4
A208C59	107282	DM10-220J	02799	CAPACITOR, D MICA, 22 pf	1
A208C60	107281	DM10-200J	02799	CAPACITOR, D MICA, 20 pf	1
A208C61	100272	DM10-100J	02799	CAPACITOR, D MICA, 10 pf	1
A208C62	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	1
A208C63	100203	150D225X9020A2	56289	CAPACITOR, TANT, 2.2 uf, 20V, 10%	1
A208C64 thru C67	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	4
A208C70 thru C75	107291	TG-S10	56289	CAPACITOR, C DIP, 0.01 uf, 100V, 20%	6
A208CR1 thru CR5	107042	1N914		DIODE, SIGNAL, 100V	5
A208CR7 thru CR9	107042	1N914		DIODE, SIGNAL, 100V	3
A208CR11 thru CR13	107042	1N914		DIODE, SIGNAL, 100V	3
A208CR15 thru CR21	107042	1N914		DIODE, SIGNAL, 100V	7
A208L1 thru L4	101297	WEE-470	43543	INDUCTOR, FIXED, 740 uH	4
A208L5	107325	WEE-4.7	43543	INDUCTOR, FIXED, 4.7 uH	1
A208L6	109589			INDUCTOR, VAR	1
A208L7	101306	WEE-100	43543	INDUCTOR, FIXED, 100 uH	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A208L8, L9	109589			INDUCTOR, VAR	2
A208L10	101306	WEE-100	43543	INDUCTOR, FIXED, 100 uH	1
A208L11	107328	1025-54	99800	INDUCTOR, FIXED, 27 uH	1
A208L12	101297	WEE-470	43543	INDUCTOR, FIXED, 470 uH	1
A208L13, L14	107325	WEE-4.7	43543	INDUCTOR, FIXED, 4.7 uH	2
A208L15	101306	WEE-100	43543	INDUCTOR, FIXED, 100 uH	1
A208Q1, Q2	107011	2N3641		TRANSISTOR	2
A208Q3	109542			TRANSISTOR	1
A208Q4	107011	2N3641		TRANSISTOR	1
A208Q5	109542			TRANSISTOR	1
A208Q6, Q7	107011	2N3641		TRANSISTOR	2
A208Q8	109542			TRANSISTOR	1
A208Q9, Q10	107011	2N3641		TRANSISTOR	2
A208Q11	107316	2N3638A		TRANSISTOR	1
A208Q12, Q13	107011	2N3641		TRANSISTOR	2
A208R1	101565	RC07GF123J		RESISTOR, CC, 12K, 1/4W, 5%	1
A208R3	101541	RC07GF512J		RESISTOR, CC, 5.1K, 1/4W, 5%	1
A208R4	101570	RC07GF103J		RESISTOR, CC, 10K, 1/4W, 5%	1
A208R5	101670	RC07GF203J		RESISTOR, CC, 20K, 1/4W, 5%	1
A208R6	101664	RC07GF111J		RESISTOR, CC, 110 OHM, 1/4W, 5%	1
A208R7	101569	RC07GF102J		RESISTOR, CC, 1K, 1/4W, 5%	1
A208R8	101754	RC07GF113J		RESISTOR, CC, 11K, 1/4W, 5%	1
A208R9	101565	RC07GF123J		RESISTOR, CC, 12K, 1/4W, 5%	1
A208R10	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A208R11	101774	RC07GF431J		RESISTOR, CC, 430 OHM, 1/4W, 5%	1
A208R12	101559	RC07GF332J		RESISTOR, CC, 3.3K, 1/4W, 5%	1
A208R13	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A208R14	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A208R15	107582	RN55D90R9F		RESISTOR, MF, 90.9 OHM, 1/8W, 1%	1
A208R16	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A208R17	107457	RN55D3320F		RESISTOR, MF, 332 OHM, 1/8W, 1%	1
A208R20	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A208R21	107470	RN55D1431F		RESISTOR, MF, 1.43K, 1/8W, 1%	1
A208R22	101669	RC07GF681J		RESISTOR, CC, 680 OHM, 1/4W, 5%	1
A208R23	101542	RC07GF271J		RESISTOR, CC, 270 OHM, 1/4W, 5%	1
A208R24	101668	RC07GF181J		RESISTOR, CC, 180 OHM, 1/4W, 5%	1
A208R25	101581	RC07GF122J		RESISTOR, CC, 1.2K, 1/4W, 5%	1
A208R26	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A208R27	101577	RC07GF152J		RESISTOR, CC, 1.5K, 1/4W, 5%	1
A208R28	101754	RC07GF113J		RESISTOR, CC, 11K, 1/4W, 5%	1
A208R29	101664	RC07GF111J		RESISTOR, CC, 110 OHM, 1/4W, 5%	1
A208R30	101565	RC07GF123J		RESISTOR, CC, 12K, 1/4W, 5%	1
A208R31	101569	RC07GF102J		RESISTOR, CC, 1K, 1/4W, 5%	1
A208R32	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A208R33	101559	RC07GF332J		RESISTOR, CC, 3.3K, 1/4W, 5%	1
A208R34	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A208R35	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A208R36	107582	RN55D90R9F		RESISTOR, MF, 90.9 OHM, 1/8W, 1%	1
A208R37	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A208R38	107457	RN55D3320F		RESISTOR, MF, 332 OHM, 1/8W, 1%	1
A208R41	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A208R42	107470	RN55D1431F		RESISTOR, MF, 1.43K, 1/8W, 1%	1
A208R43	101669	RC07GF681J		RESISTOR, CC, 680 OHM, 1/4W, 5%	1
A208R44	101542	RC07GF271J		RESISTOR, CC, 270 OHM, 1/4W, 5%	1
A208R45	101668	RC07GF181J		RESISTOR, CC, 180 OHM, 1/4W, 5%	1
A208R46	101581	RC07GF122J		RESISTOR, CC, 1.2K, 1/4W, 5%	1
A208R47	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A208R48	101577	RC07GF152J		RESISTOR, CC, 1.5K, 1/4W, 5%	1
A208R49	101664	RC07GF111J		RESISTOR, CC, 110 OHM, 1/4W, 5%	1
A208R50	101754	RC07GF113J		RESISTOR, CC, 11K, 1/4W, 5%	1
A208R51	101569	RC07GF102J		RESISTOR, CC, 1K, 1/4W, 5%	1
A208R52	101565	RC07GF123J		RESISTOR, CC, 12K, 1/4W, 5%	1
A208R53	101774	RC07GF431J		RESISTOR, CC, 430 OHM, 1/4W, 5%	1
A208R54	101559	RC07GF332J		RESISTOR, CC, 3.3K, 1/4W, 5%	1
A208R55, R56	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	2

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A208R57	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A208R58	107582	RN55D90R9F		RESISTOR, MF, 90.9 OHM, 1/8W, 1%	1
A208R59	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A208R60	107457	RN55D3320F		RESISTOR, MF, 332 OHM, 1/8W, 1%	1
A208R63	101598	RC07GF472J		RESISTOR, CC, 4.7K, 1/4W, 5%	1
A208R64	107470	RN55D1431F		RESISTOR, MF, 1.43K, 1/8W, 1%	1
A208R65	101669	RC07GF681J		RESISTOR, CC, 680 OHM, 1/4W, 5%	1
A208R66	101542	RC07GF271J		RESISTOR, CC, 270 OHM, 1/4W, 5%	1
A208R67	101668	RC07GF181J		RESISTOR, CC, 180 OHM, 1/4W, 5%	1
A208R68	101581	RC07GF122J		RESISTOR, CC, 1.2K, 1/4W, 5%	1
A208R69	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A208R70	101577	RC07GF152J		RESISTOR, CC, 1.5K, 1/4W, 5%	1
A208R71	101565	RC07GF123J		RESISTOR, CC, 12K, 1/4W, 5%	1
A208R72	101593	RC07GF163J		RESISTOR, CC, 16K, 1/4W, 5%	1
A208R73	101536	RC07GF331J		RESISTOR, CC, 330 OHM, 1/4W, 5%	1
A208R74	101557	RC07GF100J		RESISTOR, CC, 10 OHM, 1/4W, 5%	1
A208R75	101609	RC07GF101J		RESISTOR, CC, 100 OHM, 1/4W, 5%	1
A208R76	101562	RC07GF222J		RESISTOR, CC, 2.2K, 1/4W, 5%	1
A208R77	101574	RC07GF473J		RESISTOR, CC, 47K, 1/4W, 5%	1
A208R78	101570	RC07GF103J		RESISTOR, CC, 10K, 1/4W, 5%	1
A208R79	101569	RC07GF102J		RESISTOR, CC, 1K, 1/4W, 5%	1
A208R80	101745	RC07GF361J		RESISTOR, CC, 360 OHM, 1/4W, 5%	1
A208R81	101672	RC07GF510J		RESISTOR, CC, 51 OHM, 1/4W, 5%	1
A208R82	101588	RC07GF241J		RESISTOR, CC, 240 OHM, 1/4W, 5%	1
A208R83	101567	RC07GF821J		RESISTOR, CC, 820 OHM, 1/4W, 5%	1
A208R86, R87	107030	362Y501B	71450	POTENTIOMETER, 1T, PC, 500 OHM	2
A208R89	101626	RC07GF242J		RESISTOR, CC, 2.4K, 1/4W, 5%	1
A208R90	101562	RC07GF222J		RESISTOR, CC, 2.2K, 1/4W, 5%	1
A208R93	107028	3624102B	71450	POTENTIOMETER, 1T, PC, 1K	1
A208R94	101541	RC07GF512J		RESISTOR, CC, 5.1K, 1/4W, 5%	1
A208R95 thru R97	107025	RN55D4322F		RESISTOR, MF, 43.2K, 1/8W, 1%	3
A208R98	101774	RC07GF431J		RESISTOR, CC, 430 OHM, 1/4W, 5%	1
A208R99	107031	362Y502B	71450	POTENTIOMETER, IT, PC, 5K	1
A208R100	101562	RC07GF222J		RESISTOR, CC, 2.2K, 1/4W, 5%	1
A208TP1 thru TP6, GND	107583	2520B-1	88245	PIN, PC	6
A208TP7 thru TP12	107121	85931-6	89110	PIN, PC	6
A208X1 thru X3	107346	8000-AG36	91506	CRYSTAL HOLDER	3
A208Y1 thru Y3	109043			CRYSTAL, 6.5 MHz (Set consists of 3 crystals as matched set)	1 Set

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A209	109191			Ø LOCK ASSY Consisting of:	1
A209AR1	107321	U5B7709393	07263	INTEGRATED CIRCUIT	1
A209C1	100211	CS13BE156K		CAPACITOR, 15 uf, 20 VDC, 10%	1
A209C2 thru C3	107038	8121-100-651-103M	72982	CAPACITOR, .01 uf, 100 VDC, 20%	2
A209C4	107289	DM10-221J	02799	CAPACITOR, 220 pf, 500 VDC, 5%	1
A209C5	107284	410-B-1-B-220J	14752	CAPACITOR, 2000 pf, 100 VDC, 5%	1
A209C6, C7	107038	8121-100-651-103M	72982	CAPACITOR, .01 uf, 100 VDC, 20%	2
A209C8	100211	CS13BE156K		CAPACITOR, 15 uf, 20 VDC, 10%	1
A209C9	107280	410-B-1-B-432J	14752	CAPACITOR, 4300 pf, 100 VDC, 5%	1
A209C10	107040	8131-100-651-224M	72982	CAPACITOR, .22 uf, 100 VDC, 20%	1
A209C11	107307	MTP-106M030P1A	90201	CAPACITOR, 10 uf, 30 W VDC	1
A209C12	107310	SC27BX102KS	32159	CAPACITOR, CHIP, 1000 pf, 50V	1
A209C16	100211	CS13BE156K2		CAPACITOR, 15 uf, 20 VDC	1
A209C17	107038	8121-100-651-103M	72982	CAPACITOR, .01 uf, 100 VDC, 20%	1
A209C18	100211	CS13BE156K2		CAPACITOR, 15 uf, 20 VDC	1
A209C19, C20	107038	8121-100-651-103M	72982	CAPACITOR, .01 uf, 100 VDC, 20%	2
A209C22	107041	197D106X9020JA1	56289	CAPACITOR, 10 uf, 20V, 10%	1
A209C23	107038	8121-100-651-103M	72982	CAPACITOR, .01 uf, 100 VDC, 20%	1
A209C24	107041	196D106X9020JA1	56289	CAPACITOR, 10 uf, 20V, 10%	1
A209C25	107038	8121-100-651-103M	72982	CAPACITOR, .01 uf, 100 VDC, 20%	1
A209C26	100252	DM10-101J	02799	CAPACITOR, 100 pf, 500 VDC, 5%	1
A209C27	100314	DM10-330J	02799	CAPACITOR, 33 pf, 500 VDC, 5%	1
A209C28, C29	107041	196D106X9020JA1	56289	CAPACITOR, 10 uf, 20V, 10%	2
A209C30	107295	8131-100-651-334M	72982	CAPACITOR, .33 uf, 100 VDC, 20%	1
A209C31	107039	8131-100-651-104M	72982	CAPACITOR, .1 uf, 100 VDC, 20%	1
A209C32	107038	8121-100-651-103M	72982	CAPACITOR, .01 uf, 100 VDC, 20%	1
A209C34	107041	196D106X9020JA1	56289	CAPACITOR, 10 uf, 20V, 10%	1
A209C37	107290	DM15-501J	02799	CAPACITOR, 500 pf, 500 VDC	1
A209C38	107038	8121-100-651-103M	72982	CAPACITOR, .01 uf, 100 VDC, 20%	1
A209C39	107040	8131-100-651-224M	72982	CAPACITOR, .22 uf, 100 VDC, 20%	1
A209C40	107305	123D106C7010E1	56289	CAPACITOR, NON POLARIZED, 10 uf, 10V	1
A209C41	10741	196D106X9020JA1	56289	CAPACITOR, 10 uf, 20V, 10%	1
A209C44 thru C46	107306	MTP-806-M015 P1B	90201	CAPACITOR, 80 uf, 15 VDC, 10%	3
A209C47	107308	MTP-456-M030 P1B	90201	CAPACITOR, 45 uf, 30 VDC	1
A209C48 thru C51	107300	FT3-01-1000-K	14693	CAPACITOR, FEED THRU, 1000 pf	4
A209C52 thru C54	107308	MTP-456-M030 P1B	90201	CAPACITOR, 45 uf, 30 VDC	3
A209C56	107038	8121-100-651-103M	72982	CAPACITOR, .01 uf, 100 VDC, 20%	1
A209C57	107041	196D106X9020JA1	56289	CAPACITOR, 10 uf, 20V, 10%	1
A209C58, C59	107299	FT3-01-100-K	14693	CAPACITOR, FEED THRU, 100 pf	2
A209C60, C61	107297	2425-003-W5U0-102AA	72982	CAPACITOR, FEED THRU, 1000 pf	2
A209C62	107281	DM10-200J	02799	CAPACITOR, 20 pf, 500 VDC, 5%	1
A209C63, C64	100150	DM19-152J	02799	CAPACITOR, 1500 pf, 500 VDC, 5%	2
A209C65	107295	8131-100-651-334M	72982	CAPACITOR, .33 uf, 100 VDC, 20%	1
A209C66	107294	5GA-D10	56289	CAPACITOR, .001 uf, 1000 VDC, 20%	1
A209C67	107040	8131-100-651-224M	72982	CAPACITOR, .22 uf, 100 VDC, 20%	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A209C68	107548	SC27BY1R0DS	32159	CAPACITOR, CHIP, 1 pf, 100 VDC	1
A209CR1	107313	5082-0180	28480	DIODE, -STEP RECOVERY	1
A209CR2	107314	5082-2302	28480	DIODE - HOT CARRIER	1
A209CR3	107311	1N270		DIODE	1
A209CR4, CR5	107042	1N914		DIODE	2
A209CR6, CR7	107311	1N270		DIODE	2
A209CR8	100377	1N821		DIODE	1
A209CR9 thru CR11	107042	1N914		DIODE	3
A209J1	107336	2052-1352	26805	CONNECTOR	1
A209J2, J3	107339	51-043-0060	98291	CONNECTOR	2
A209K1	107453	1A15AH	21317	RELAY	1
A209L1	109048	19160-010	10021	INDUCTOR	1
A209L2	107401	56-590-65/3B	02114	FERRITE BEAD	1
A209L3, L4	109050			INDUCTOR	2
A209Q1	102682	2N706		TRANSISTOR	1
A209Q2	107318	2N2219A		TRANSISTOR	1
A209Q3	101375	2N5248		TRANSISTOR	1
A209Q4 thru Q6	101364	2N708		TRANSISTOR	3
A209Q7	107319	2N3391A		TRANSISTOR	1
A209Q8, Q9	107318	2N2219A		TRANSISTOR	2
A209Q10	107319	2N3391A		TRANSISTOR	1
A209R1	101608	RC07GF622J		RESISTOR, 6.2K, 1/4W, 5%	1
A209R2	101626	RC07GF242J		RESISTOR, 2.4K, 1/4W, 5%	1
A209R3	101602	RC07GF182J		RESISTOR, 1.8K, 1/4W, 5%	1
A209R4	101596	RC07GF752J		RESISTOR, 7.5K, 1/4W, 5%	1
A209R5	107263	RN60D2211F		RESISTOR, 2.21K, 1/4W, 1%	1
A209R6	101609	RC07GF101J		RESISTOR, 100 OHM, 1/4W, 5%	1
A209R7	101587	RC07GF273J		RESISTOR, 27K, 1/4W, 5%	1
A209R8	101570	RC07GF103J		RESISTOR, 10K, 1/4W, 5%	1
A209R9	101498	RC20GF101J		RESISTOR, 100 OHM, 1/2W, 5%	1
A209R10	101815	RC05GF510J		RESISTOR, 51 OHM, 1/8W, 5%	1
A209R11	101808	RC05GF200J		RESISTOR, 20 OHM, 1/8W, 5%	1
A209R12	107265	RC05GF203J		RESISTOR, 20K, 1/8W, 5%	1
A209R13	107272	79PR10K		RESISTOR, 10K, POTENTIOMETER	1
A209R14	101711	RC05GF102J		RESISTOR, 1K, 1/8W, 5%	1
A209R15	101697	RC05GF103J		RESISTOR, 10K, 1/8W, 5%	1
A209R16	101799	RC05GF822J		RESISTOR, 8.2K, 1/8W, 5%	1
A209R17	101718	RC05GF513J		RESISTOR, 51K, 1/8W, 5%	1
A209R18	107272	79PR10K	73138	RESISTOR, 10K, POTENTIOMETER	1
A209R19	102039	RC05GF202J		RESISTOR, 2K, 1/8W, 5%	1
A209R20	101701	RC05GF101J		RESISTOR, 100 OHM, 1/8W, 5%	1
A209R21	101567	RC07GF821J		RESISTOR, 820 OHM, 1/4W, 5%	1
A209R22	101607	RC07GF203J		RESISTOR, 20K, 1/4W, 5%	1
A209R23	101609	RC07GF101J		RESISTOR, 100 OHM, 1/4W, 5%	1
A209R24	101569	RC07GF102J		RESISTOR, 1K, 1/4W, 5%	1
A209R25	101609	RC07GF101J		RESISTOR, 100 OHM, 1/4W, 5%	1
A209R26	101553	RC07GF202J		RESISTOR, 2K, 1/4W, 5%	1
A209R27	101593	RC07GF163J		RESISTOR, 16K, 1/4W, 5%	1
A209R28	101609	RC07GF101J		RESISTOR, 100 OHM, 1/4W, 5%	1
A209R29	101570	RC07GF103J		RESISTOR, 10K, 1/4W, 5%	1
A209R30, R31	101609	RC07GF101J		RESISTOR, 100 OHM, 1/4W, 5%	2
A209R32	101590	RC07GF513J		RESISTOR, 51K, 1/4W, 5%	1
A209R33	107274	79PR50K	73138	RESISTOR, TRIMPOT, 50K	1
A209R34	107271	79PR1K	73138	RESISTOR, TRIMPOT, 1K	1
A209R35	107026	RN55D5110F		RESISTOR, 511 OHM, 1/8W, 1%	1
A209R37	107273	79PR20K	73138	RESISTOR, TRIMPOT, 20K	1
A209R38	101553	RC07GF202J		RESISTOR, 2K, 1/4W, 5%	1
A209R39	107246	RN55D5621F		RESISTOR, 5.62K, 1/8W, 1%	1
A209R40	101577	RC07GF152J		RESISTOR, 1.5K, 1/4W, 5%	1
A209R42	107261	RN55D5112F		RESISTOR, 51.1K, 1/8W, 1%	1
A209R43	107271	79PR1K	73138	RESISTOR, TRIMPOT, 1K	1
A209R44, R45	101609	RC07GF101J		RESISTOR, 100 OHM, 1/4W, 5%	2
A209R46	101569	RC07GF102J		RESISTOR, 1K, 1/4W, 5%	1
A209R47	101590	RC07GF513J		RESISTOR, 51K, 1/4W, 5%	1
A209R48	101595	RC07GF882J		RESISTOR, 8.2K, 1/4W, 5%	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A209R49	101553	RC07GF202J		RESISTOR, 2K, 1/4W, 5%	1
A209R50	101552	RC07GF153J		RESISTOR, 15K, 1/4W, 5%	1
A209R51	101577	RC07GF152J		RESISTOR, 1.5K, 1/4W, 5%	1
A209R52	101467	RC20GF102J		RESISTOR, 1K, 1/2W, 5%	1
A209R53, R54	101798	RC05GF221J		RESISTOR, 220 OHM, 1/8W, 5%	2
A209R55	101554	RC07GF243J		RESISTOR, 24K, 1/4W, 5%	1
A209R56	101815	RC05GF510J		RESISTOR, 51 OHM, 1/8W, 5%	1
A209R57	107262	RN55D1503F		RESISTOR, 150K, 1/8W, 1%	1
A209T1	109049	19160-011	01121	TRANSFORMER	1
A209X1, X2	109044			CRYSTAL (FREQ) 1 MHz	2
	10919201			REF. OSC & INDICATOR DRIVER BOARD ASSY	1
	10919301			AMP & LOW PASS FILTER BOARD ASSY	1
	10919401			PHASE DETECTOR MODULE ASSY	1
	10919501			PHASE DETECTOR SAMPLER BOARD ASSY	1
	109196			CABLE ASSY - Ø LOCK	1
	109197			CABLE ASSY - Ø LOCK	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A210	109498			SWITCH ASSY - BANDWIDTH Consisting of:	1
A210CR1, CR2	107120	1N914 (DO 35 CASE)		DIODE	2
A210R1	109046			POTENTIOMETER	1
A210S1	109042			SWITCH	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A211	10920201			RF BOARD ASSY Consisting of:	1
A211AR1 thru AR8	109378	U9T7741-393	07263	INTEGRATED CIRCUIT	8
A211C1	100063	CS13BE106K		CAPACITOR, 10 uf, 20V, 10%	1
A211C2	106527	15D22GX0035R2	56289	CAPACITOR, 22 uf, 35V, 20%	1
A211C3	107109	CS13BD275K		CAPACITOR, 2.7 uf, 15V, 10%	1
A211C4	100196	TE1164	56289	CAPACITOR, 200 uf, 15V	1
A211C5	107447	5C023474X250B3	56289	CAPACITOR, 0.47 uf, 25V, 20%	1
A211C6	100063	CS13BE106K		CAPACITOR, 10 uf, 20V, 10%	1
A211C7	100182	CS13BF685K		CAPACITOR, 6.8 uf, 35V, 10%	1
A211C9	107446	196D106X9035LA3	56289	CAPACITOR, 10 uf, 35V, 10%	1
A211C10	107034	DM5-120K	72136	CAPACITOR, 12 pf	1
A211CR1 thru CR16	107120	1N914 (DO 35 CASE)		DIODE	16
A211CR20 thru CR27	107120	1N914 (DO 35 CASE)		DIODE	8
A211J1	107216	C821450	33809	CONNECTOR, SOCKET	1
A211J2	107049	C821650	33809	CONNECTOR, SOCKET	1
A211J3	107448	3429-2002	75037	CONNECTOR	1
A211K1	107469	EAC1A5AHH	21317	RELAY, REED, 5V, SPST	1
A211K2	107324	EAC1A15AH	21317	RELAY, REED, 15V, SPST	1
A211K3	107170	EAC1C15AH	21317	RELAY, REED, 15V, SPDT	1
A211Q2	101405	2N5193		TRANSISTOR	1
A211Q4	101378	2N3906		TRANSISTOR	1
A211Q5	101405	2N5193		TRANSISTOR	1
A211R1	107435	PT10V-10K	PIHER	RESISTOR, VAR, 10K	1
A211R2	107433	RN55D3652F		RESISTOR, 36.5K, 1/8W, 1%	1
A211R3 thru R5	107434	PT10V-25K	PIHER	RESISTOR, VAR, 25K	3
A211R6 thru R8	107435	PT10V-10K	PIHER	RESISTOR, VAR, 10K	3
A211R9	107428	RN55D6810F		RESISTOR, 681 OHM, 1/8W, 1%	1
A211R10	107177	RN55D1151F		RESISTOR, 1.15K, 1/8W, 1%	1
A211R11 thru R15	107435	PT10V-10K	PIHER	RESISTOR, VAR, 10K	5
A211R19	107248	RN55D7151F		RESISTOR, 7.15K, 1/8W, 1%	1
A211R20	107249	RN55D71501F		RESISTOR, 7.5K, 1/8W, 1%	1
A211R21	107421	RN55D5111F		RESISTOR, 5.11K, 1/8W, 1%	1
A211R22	107537	RN55D4751F		RESISTOR, 4.75K, 1/8W, 1%	1
A211R23	107019	RN55D1501F		RESISTOR, 1.5K, 1/8W, 1%	1
A211R24	107016	RN55D1001F		RESISTOR, 1K, 1/8W, 1%	1
A211R25	107432	RN55D1432F		RESISTOR, 14.3K, 1/8W, 1%	1
A211R26	107439	203A-1/4%-10K	15003	RESISTOR, WW, 10K, 0.1W, 1/4%	1
A211R27	107438	203A-1/4%-6.25K	15003	RESISTOR, WW, 6.25K, 0.1W, 1/4%	1
A211R28	107178	RN55D2003F		RESISTOR, 200K, 1/8W, 1%	1
A211R30	107426	RN55D47R5F		RESISTOR, 47.5 OHM, 1/8W, 1%	1
A211R31	102530	EB10G5	01121	RESISTOR, 10 OHM, 1/2W, 5%	1
A211R32	107019	RN55D1501F		RESISTOR, 1.5K, 1/8W, 1%	1
A211R33	107431	RN55D9091F		RESISTOR, 9.09K, 1/8W, 1%	1
A211R34	107430	RN55D3571F		RESISTOR, 3.57K, 1/8W, 1%	1
A211R35	107026	RN55D5110F		RESISTOR, 511 OHM, 1/8W, 1%	1
A211R36	107440	3305W1-501	32997	RESISTOR, VAR, PC, 500 OHM, 1/2W, ±5%	1
A211R38	107429	RN55D1301F		RESISTOR, 1.3K, 1/8W, 1%	1
A211R39	107221	RN55D10R0		RESISTOR, 10 OHM, 1/8W, 1%	1
A211R40	107437	203A-1/4%-3.3K	15003	RESISTOR, WW, 3.3K, 0.1W, 1/4%	1
A211R41	107441	3305P1-501	32997	RESISTOR, VAR, PC, 500 OHM, 1/2W, ±5%	1
A211R42	107436	203A-1/4%-3K	15003	RESISTOR, WW, 3.0K, 0.1W, 1/4%	1
A211R43	107229	RN55D1000F		RESISTOR, 100 OHM, 1/8W, 1%	1
A211R44	107427	RN55D2210F		RESISTOR, 221 OHM, 1/8W, 1%	1
A211R45	107254	RN55D1502F		RESISTOR, 15K, 1/8W, 1%	1
A211R46	107440	3305W1-501	32997	RESISTOR, VAR, PC, 500 OHM, 1/2W, ±5%	1
A211R47	107619	242E2015	56289	RESISTOR, WW, 200 OHM, 3W, 5%	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A211R48	107620	TR-7-46OHM	01686	RESISTOR, WW, 460 OHM, 7W, 1%	1
A211R49	107206	RN55D2001F		RESISTOR, 2K, 1/8W, 1%	1
A211R50	107016	RN55D1001F		RESISTOR, 1K, 1/8W, 1%	1
A211R51	107444	PT10V-1.0K	PIHER	RESISTOR, VAR, 1K	1
A211R52	107206	RN55D2001F		RESISTOR, 2K, 1/8W, 1%	1
A211R53	107253	RN55D1302F		RESISTOR, 13K, 1/8W, 1%	1
A211R56	107470	RN55D1431F		RESISTOR, 1.43K, 1/8W, 1%	1
A211R57	107022	RN55D3012F		RESISTOR, 30.1K, 1/8W, 1%	1
A211VR1	107119	1N4747		DIODE	1
A211VR2	107451	1N825		DIODE, SELECT FROM 5.88 to 6.25V, 7.5 Ma, 0°C to 70°C	1
A211Y202	109203			OSCILLATOR ASSY, 1.79 GHz	1
A211Z1	107452	LM304H	27014	INTEGRATED CIRCUIT, VOLTAGE REGULATOR	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
A212	109173			SWITCH ASSY - FREQ SPAN Consisting of:	1
A212R1	107237	RN55D1101F		RESISTOR, 1.1K, 1/8W, 5%	1
A212R2	107238	RN55D1241F		RESISTOR, 1.24K, 1/8W, 5%	1
A212R4, R5	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 5%	2
A212R6	107016	RN55D1001F		RESISTOR, 1K, 1/8W, 5%	1
A212R7	109312			POTENTIOMETER	1
A212R8	107206	RN55D2001F		RESISTOR, 2K, 1/8W, 5%	1
A212R10	107250	RN55D8061F		RESISTOR, 8.06K, 1/8W, 5%	1
A212R12	107255	RN55D1822F		RESISTOR, 18.2K, 1/8W, 5%	1
A212R13	107016	RN55D1001F		RESISTOR, 1K, 1/8W, 5%	1
AR201	109186			AMPLIFIER - 206 MHz	1
AT201	109177			R.F. ATTENUATOR	1
AT202	109174			I.F. ATTEN ASSY Consisting of:	1
AT202J1, J2	107339	51-043-0000	98291	CONNECTOR	2
AT202R4	107236	RN55D8660F		RESISTOR, 866 OHM, 1/8W, 1%	1
AT202R5, R6	107222	RN55D11R5F		RESISTOR, 11.5 OHM, 1/8W, 1%	2
AT202R7	107236	RN55D8660F		RESISTOR, 866 OHM, 1/8W, 1%	1
AT202R8	107235	RN55D4320F		RESISTOR, 432 OHM 1/8W, 1%	1
AT202R9	107222	RN55D11R5F		RESISTOR, 11.5 OHM, 1/8W, 1%	1
AT202R10	107235	RN55D4320F		RESISTOR, 432 OHM, 1/8W, 1%	1
AT202R11	107234	RN55D2940F		RESISTOR, 294 OHM, 1/8W, 1%	1
AT202R12	107223	RN55D17R8F		RESISTOR, 17.8 OHM, 1/8W, 1%	1
AT202R13	107234	RN55D2940F		RESISTOR, 294 OHM, 1/8W, 1%	1
AT202R14	107226	RN55D60R4F		RESISTOR, 60.4 OHM, 1/8W, 1%	1
AT202R15	107233	RN55D2490F		RESISTOR, 249 OHM, 1/8W, 1%	1
AT202R16	107226	RN55D60R4F		RESISTOR, 60.4 OHM, 1/8W, 1%	1
AT202R17	107288	RN55D95R3F		RESISTOR, 95.3 OHM, 1/8W, 1%	1
AT202R18	107227	RN55D71R5F		RESISTOR, 71.5 OHM, 1/8W, 1%	1
AT202R19	107288	RN55D95R3F		RESISTOR, 95.3 OHM, 1/8W, 1%	1
AT202R20	107231	RN55D1780F		RESISTOR, 178 OHM, 1/8W, 1%	1
AT202R21	107224	RN55D30R1F		RESISTOR, 30.1 OHM, 1/8W, 1%	1
AT202R22	107231	RN55D1780F		RESISTOR, 178 OHM, 1/8W, 1%	1
AT202S1 thru S6	107110	7201-S-Y-ZB-E	09353	SWITCH, TOGGLE DPDT	6
AT203	109214			ISOLATOR	1
AT204	107510	4110P		TERMINATION, COAX	1
AT205	107200	4403		ATTENUATOR	1
C201 thru C216	107039	8131-100-651-104M	72982	CAPACITOR, 0.1 uf, 100V	16
C217	107291	TG-S10	56289	CAPACITOR, .01 uf, 100V	1
C218	100100	150D225X9035B2	56289	CAPACITOR, 2.2 uf, 35V	1
C219	100063	150D106X9020B2	56289	CAPACITOR, 10 uf, 20V	1
C220	100100	150D225X9035B2	56289	CAPACITOR, 2.2 uf, 35V	1
C221	107496	8131-50-651-224M	72982	CAPACITOR, .22 uf, 50V	1
C222	107039	8131-100-651-104M	72982	CAPACITOR, 0.1 uf, 100V	1
C225	107109	CS13BD275K		CAPACITOR, 2.7 uf, 15V, 10%	1
C226	107039	8131-100-651-104M	72982	CAPACITOR, 0.1 uf, 100V	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
CR201, CR202	107494	1N4001		CAPACITOR, 2.7 uf, 15V, 10%	2
CR203	107119	1N4747	04713	DIODE, ZENER	1
CR204 thru CR206	107120	1N914 (DO 35 CASE)		DIODE, SWITCHING	3
DC201	109185			COUPLER - 20 dB	1
DS201	100456	5082-4440	28480	LAMP	1
FL201	109188			FILTER ASSY, 2050 MHz, B/P-L/P	1
HY201	109217			CIRCULATOR	1
K201	109153			RELAY	1
L202 thru L220	101306	WEE-100	43543	INDUCTOR	19
L221	107611	T37-12	Micro-met	TOROIDAL CORE	1
P201	107094	26-159-24	02660	CONNECTOR	1
PS201	045293	LM320K-15	12040	POWER SUPPLY -15V	1
PS202	045282	781FKC	07263	POWER SUPPLY +15V	1
R201	109201		02111	POTENTIOMETER, 5K, 2W, .1%	1
R202	107108	RV6NAYSD103A	80294	RESISTOR - VARIABLE, 10K, 1/2W	1
R203	101589	RC07GF112J		RESISTOR, 1.1K, 1/4W, 5%	1
R204	107022	RN55D3012F		RESISTOR, 30K, 1/8W, 1%	1
R206	107017	RN55D1002F		RESISTOR, 10K, 1/8W, 1%	1
R209	107177	RN55D1151F		RESISTOR, 1.15K, 1/8W, 1%	1
R214	107432	RN55D1432F		RESISTOR, 14.3K, 1/8W, 1%	1
R215	107775	WA2G040P103UA	01121	RESISTOR, VAR, 10K	1
R218 thru R220	101558	RC07GF104J		RESISTOR, 100K	3
R221	107554	WA2G056S203UA	01221	RESISTOR, VAR, 2K	1
S203	107111	MST-305H	95146	SWITCH, 3PDT, FULL SWEEP	1
S204	109457			SWITCH ASSY - DISPLAY LAW	1
S205	109176			SWITCH - VIDEO DURATION	1
S206	107110	7201-S-Y-Z8	09353	SWITCH, TOGGLE DPDT	1
S208	109515			RF COAX SWITCH	1
W202	109511			CABLE ASSY	1
W203	109223			CABLE ASSY	1
W204	109224			CABLE ASSY	1
W205	109486			CABLE ASSY	1
W206	109226			CABLE ASSY	1
W207	109512			CABLE ASSY	1
W208	109228			CABLE ASSY	1
W209	109229			CABLE ASSY	1
W210	109513			CABLE ASSY	1
W211	109231			CABLE ASSY	1
W212	109232			CABLE ASSY	1
	109166			CABLE ASSY, Interconnect - RF Board	1
W213	109233			CABLE ASSY	1
W214	109234			CABLE ASSY	1
W215	109235			CABLE ASSY (CARD RACK TO A208)	1
W216	109236			CABLE ASSY	1
W217	109237			CABLE ASSY	1
W218	109238			CABLE ASSY	1
W219	109242			CABLE ASSY	1
W220	109243			CABLE ASSY	1
W221	109577			CABLE ASSY	1
Y201	109143			YIG OSC	1
Y202	109203			OSC ASSY, 1.79 GHz	1
Z201	109218			EXT, MIXER BIAS BLOCK	1
Z202	109179			1ST MIXER ASSY	1
Z202C1	100203	CS13BE225K		CAPACITOR, 2.2 uf, 20V, 10%	1
Z202CR1	109045			DIODE	1
Z203	109216			2ND MIXER	1
Z204	109220			DC BLOCK	1
	109323			CARD RACK & FRONT PANEL ASSY	1
	109482			CARD RACK SUB ASSY	1
	109135			CONNECTOR MTG BRACKET ASSY	1
	107405	HB15S2	81312	CONNECTOR	7
	107095	HBD15S2	81312	CONNECTOR	1
	109144			COVER	1

REFERENCE DESIGNATION	S-D PART NUMBER	MANUFACTURER'S PART NUMBER	MFR	DESCRIPTION	QTY
	109198			FREQ, DIAL ASSY	1
	107104	IRQ-7500-2-BLK	21604	KNOB	1
	107106	IRQ-7505-2-BLK	21604	KNOB, BAR	1
	109270			KNOB, FREQUENCY SPAN/DIV	1
	107105	IRQ-5000-I/IRC-7503-2 BLK	21604	KNOB, CONCENTRIC	1
	109136			RF DECK ASSY	1
	109241			TOOL-BOARD EXTRACTION	1
	109147			LOCK LEVER	1
	109148			PIVOT PIN	1
	109149			SPRING	1
	109146			LEVER MTG PLATE	1
	109166			CABLE ASSY, INTERCONN-RF BOARD	1

SECTION IX

CIRCUIT DIAGRAMS

This section contains the following diagrams:

Figure	Title	Page
9-1	Microwave Tuning Unit IF Section, Schematic Diagram	9-3
9-2	Microwave Tuning Unit RF Deck, Schematic Diagram	9-7
9-3	3rd Converter Board A201, Schematic Diagram	9-9
9-4	4th Converter Board A202, Schematic Diagram	9-11
9-5	100 KHz B.P. Filter Board A203, Schematic Diagram	9-13
9-6	6.5 MHz Crystal Filter Board A204 & A208, Schematic Diagram	9-15
9-7	LIN-LOG Amplifier Board A205, Schematic Diagram	9-17
9-8	Harmonic Attenuator/Video Filter Duration Board A206, Schematic Diagram	9-19
9-9	100 MHz Calibrator Board A207, Schematic Diagram	9-21
9-10	Phase Lock Module A209, Schematic Diagram	9-23
9-11	RF Board A211, Schematic Diagram	9-25
9-12	IF Attenuator AT202	9-27

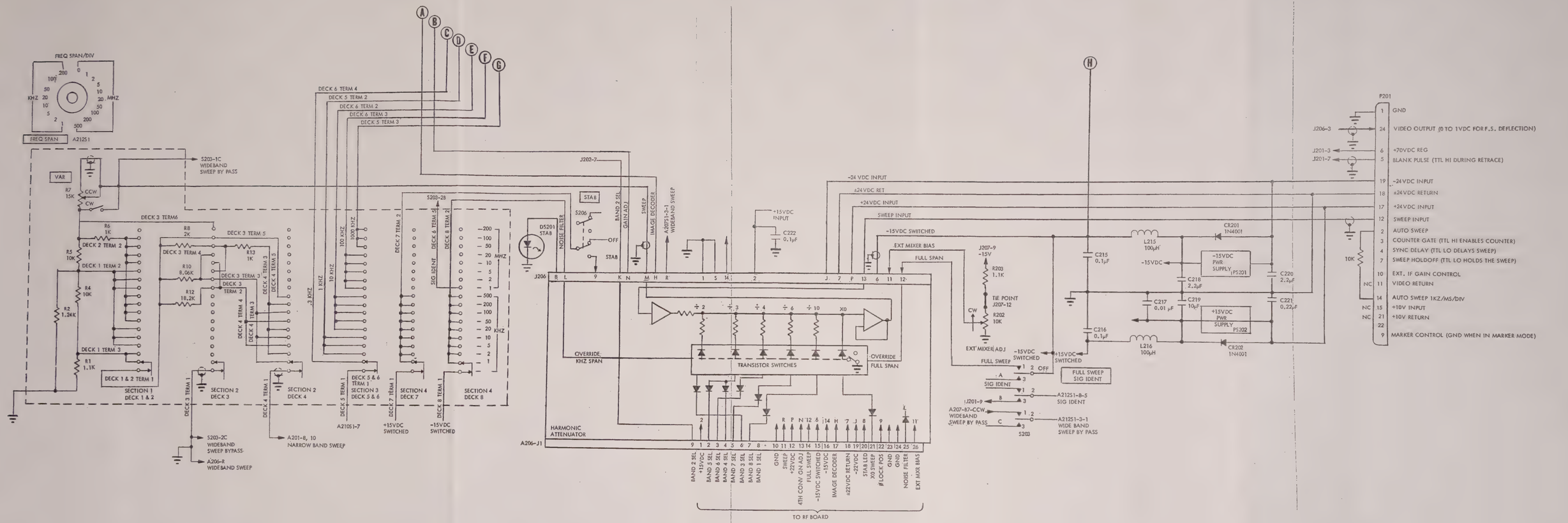


Figure 9-1. Microwave Tuning Unit IF Section, Schematic Diagram (Sheet 1 of 2)

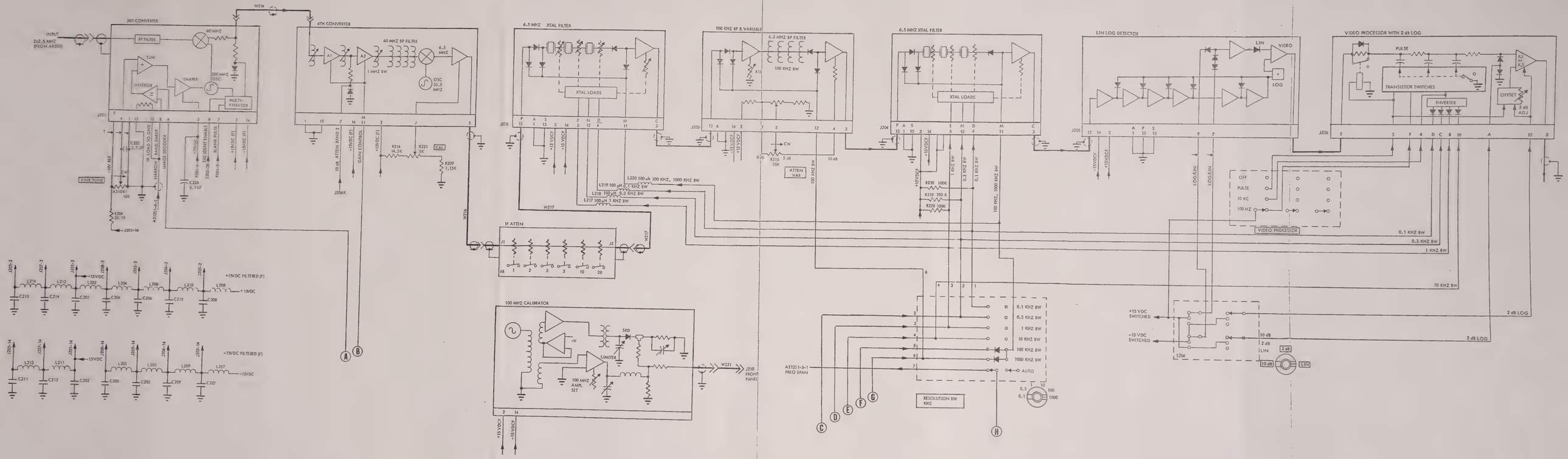


Figure 9-1. Microwave Tuning Unit IF Section, Schematic Diagram (Sheet 1 of 2)

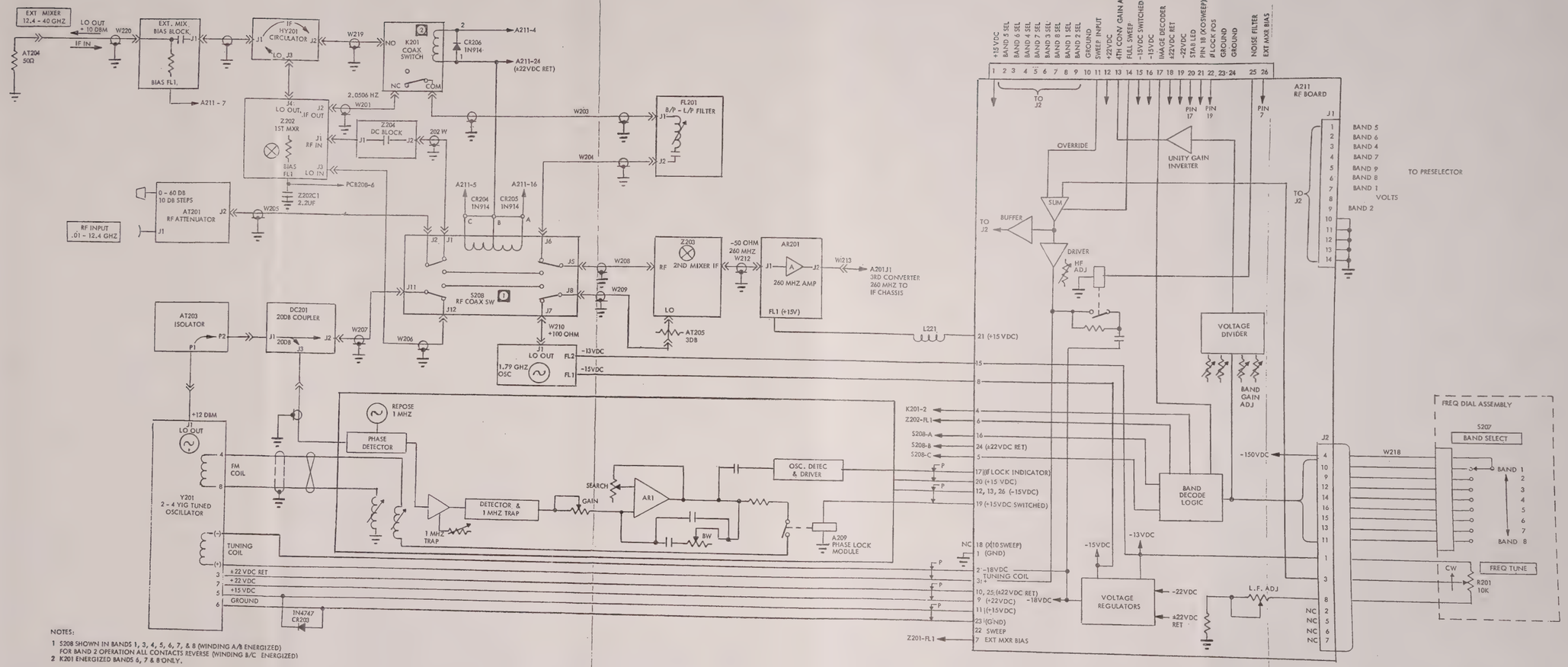


Figure 9-2. Microwave Tuning Unit RF Deck, Schematic Diagram

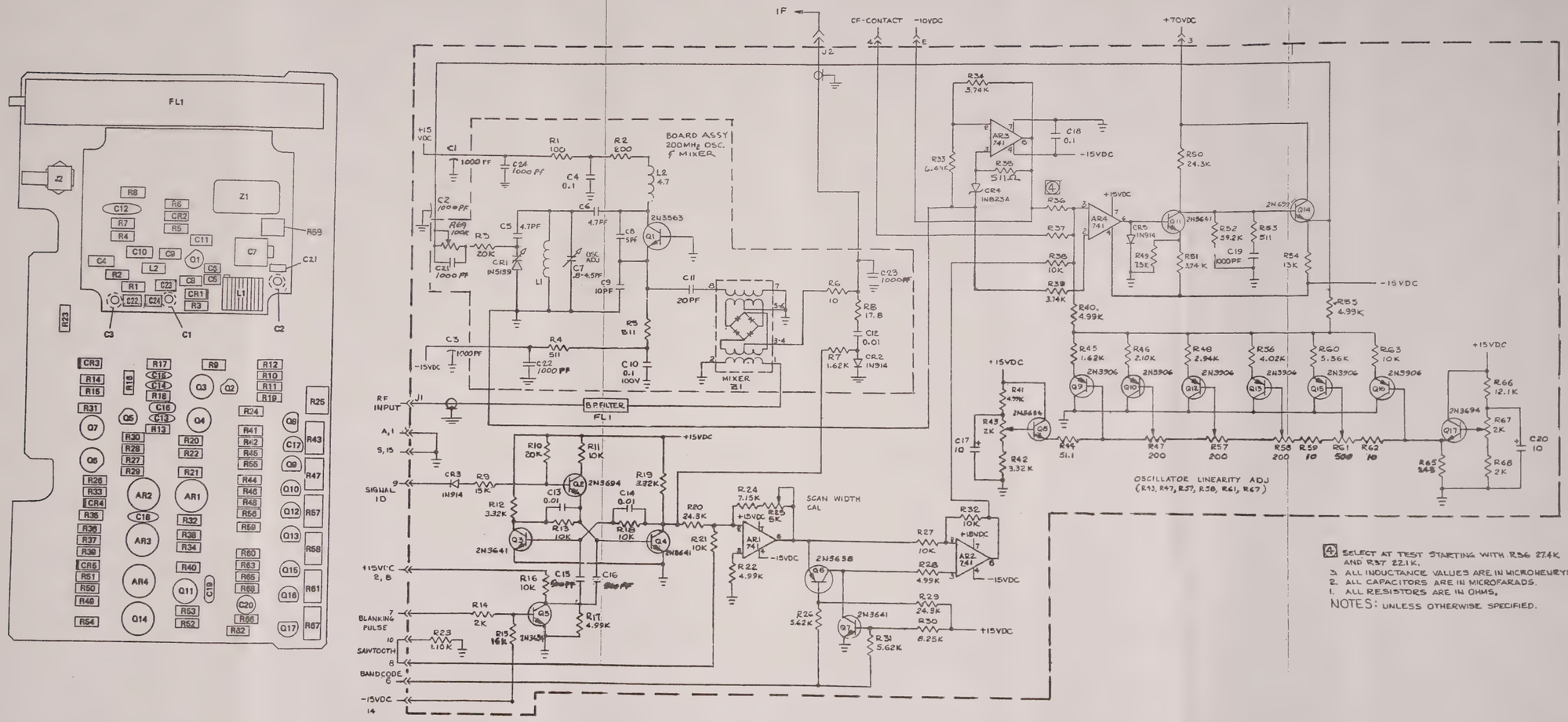
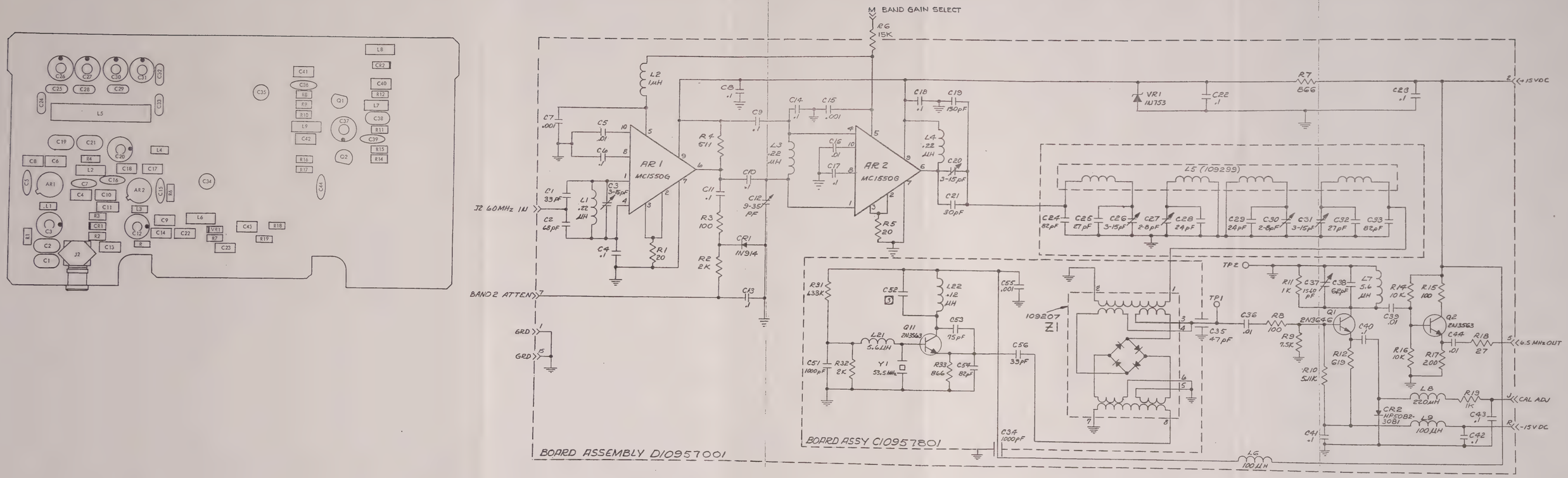
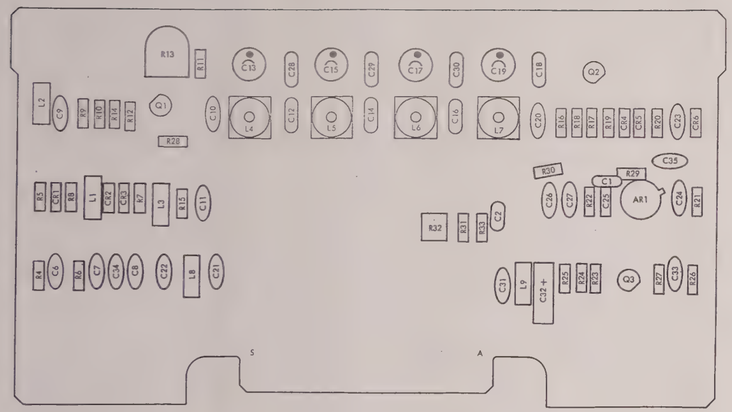


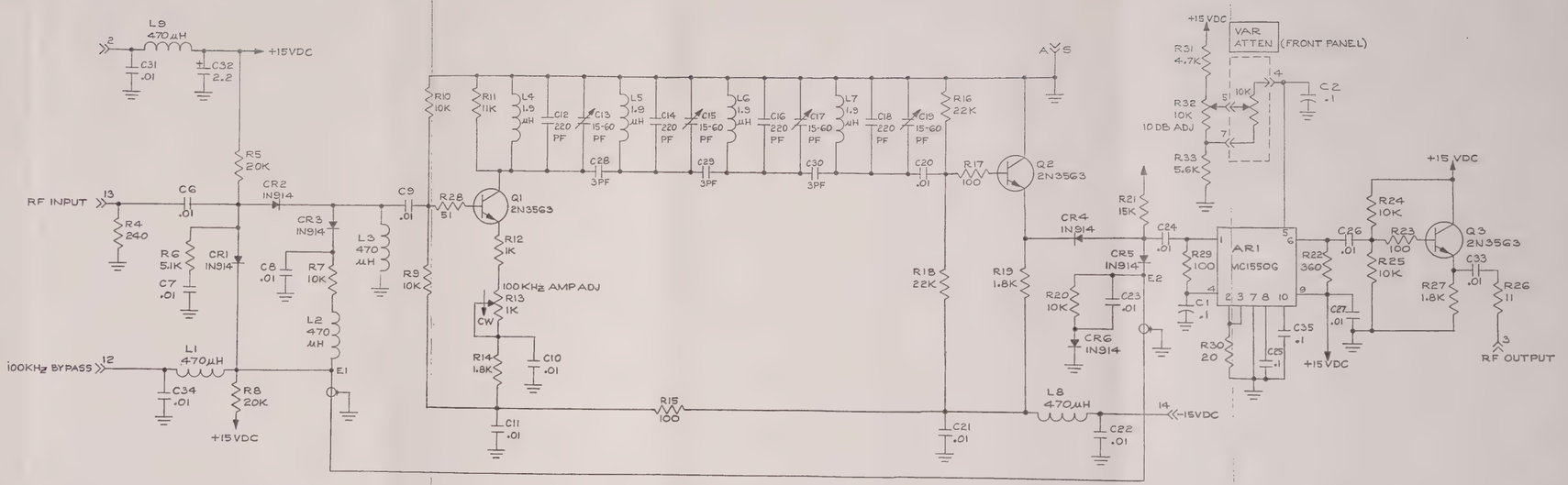
Figure 9-3. 3rd Converter Board A201, Schematic Diagram



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS
2. ALL CAPACITORS IN μF.
3. FACTORY SELECT VALUE 20pF TO 27pF.

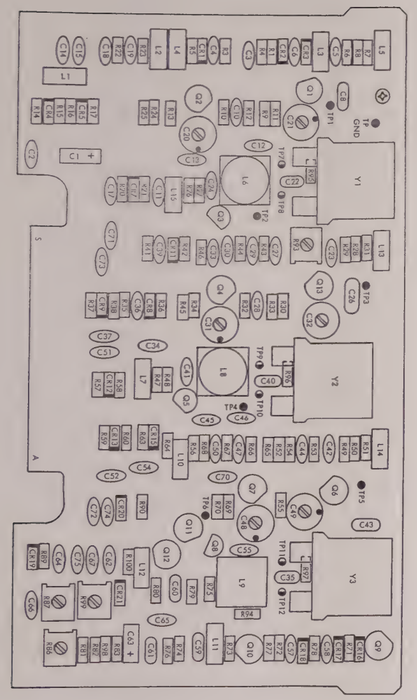
Figure 9-4. 4th Converter Board A202, Schematic Diagram

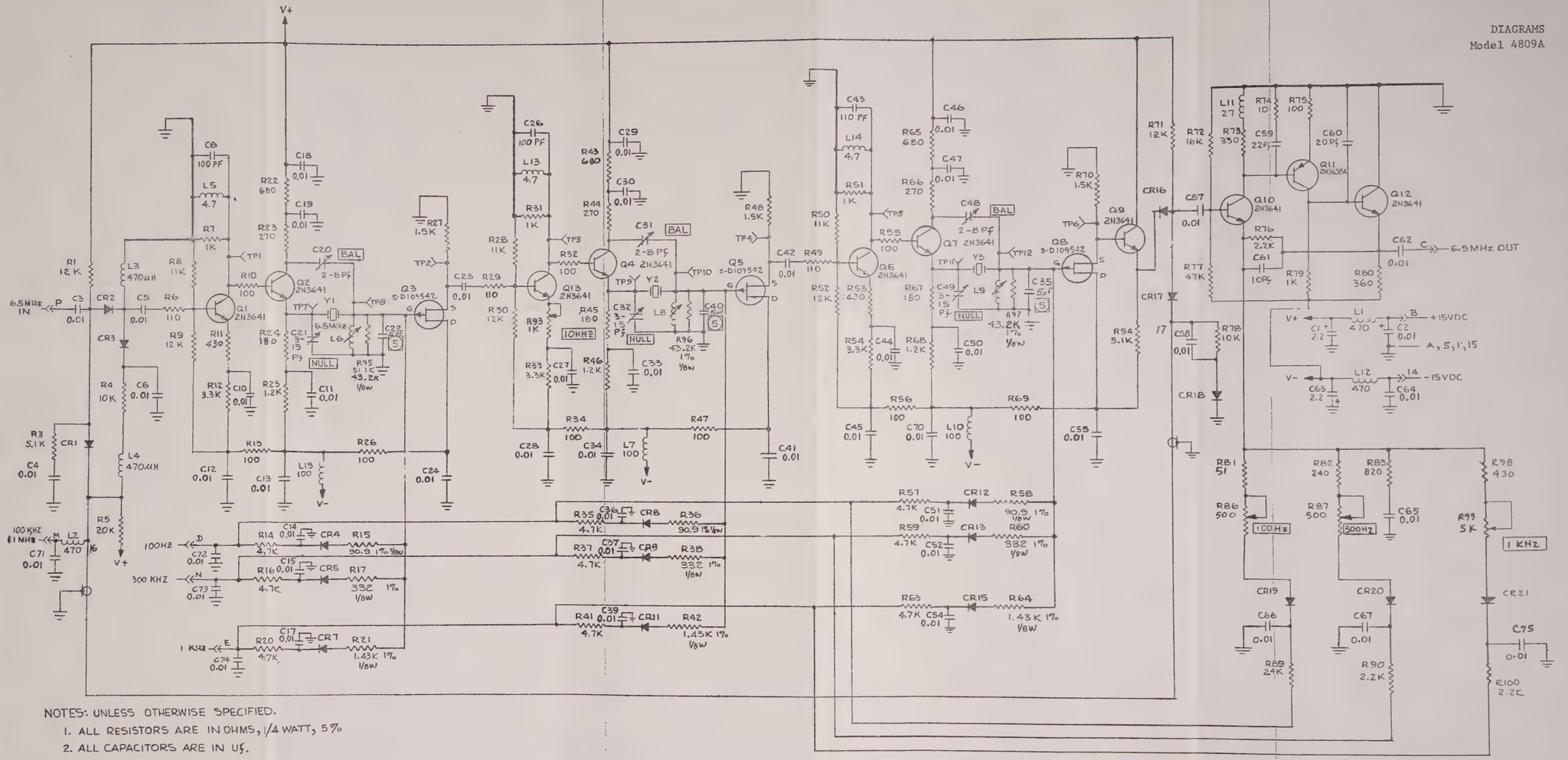




NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTORS ARE IN OHMS
2. CAPACITORS ARE IN MICROFARADS

Figure 9-5. 100 KHz B.P. Filter Board A203, Schematic Diagram



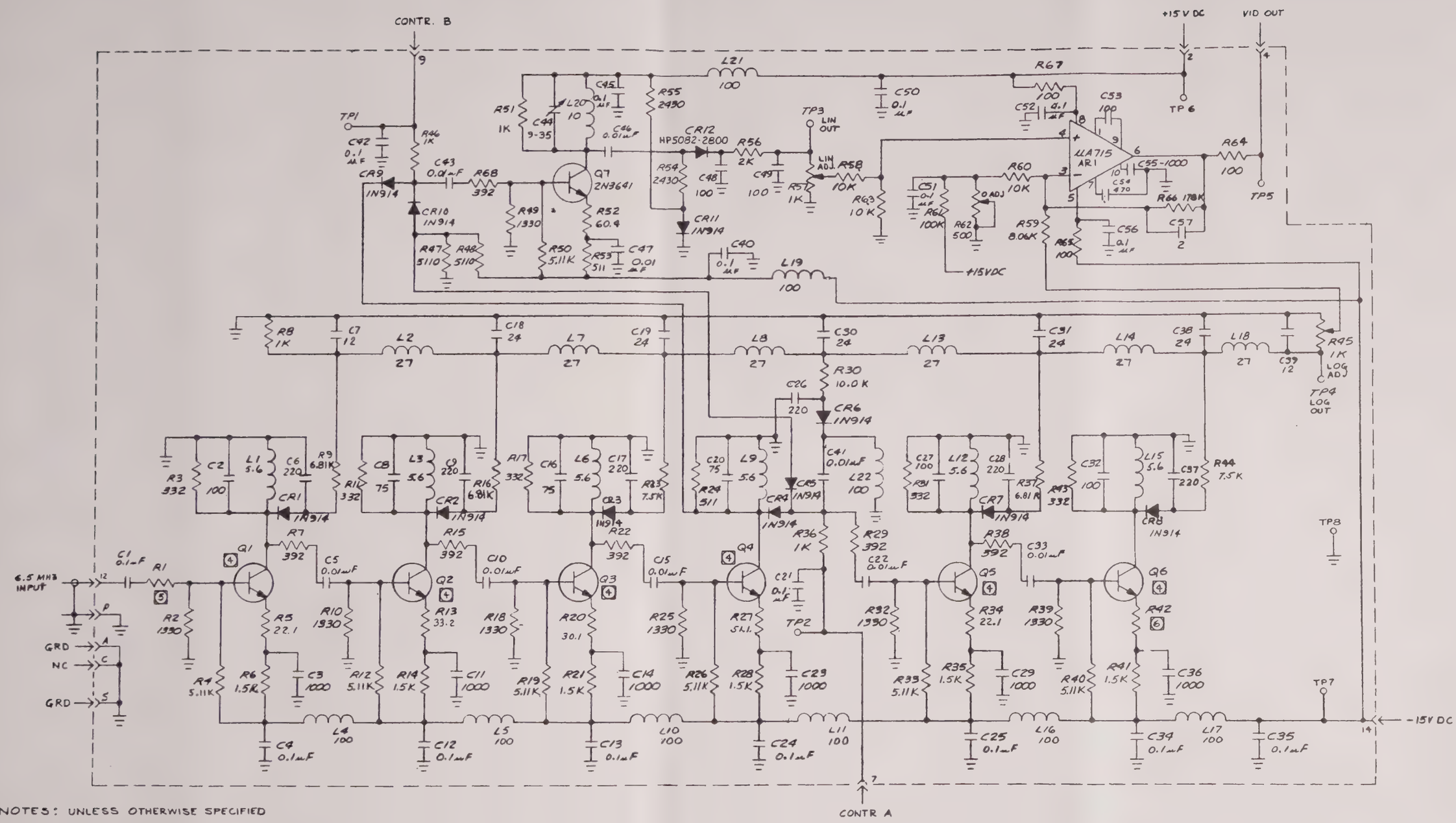


NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTORS ARE IN OHMS, 1/4 WATT, 5%
2. ALL CAPACITORS ARE IN μf.
3. ALL INDUCTORS ARE IN μH.
4. ALL DIODES ARE IN914.

[E] NOMINAL VALUE MAY BE CHANGED AT ELECTRICAL TEST.

Figure 9-6. 6.5 MHz Crystal Filter Board A204 & A208, Schematic Diagram



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL CAPACITORS ARE IN PICO FARADS.
2. ALL RESISTORS ARE OHMS.
3. ALL INDUCTORS ARE IN MICRO HENRY'S.

(4) TRANSISTORS Q1 THRU Q6 ARE 2N3646 WITH BETA 75 TO 100

(5) RESISTOR R1 IS NOM. 1.62 K, VALUES FROM 500 Ω TO 2.0K MAY BE USED

(6) RESISTOR R42 IS NOM. 20 Ω, VALUES OF 17.8 Ω OR 22.1 Ω MAY BE USED

Figure 9-7. LIN-LOG Amplifier Board A205, Schematic Diagram

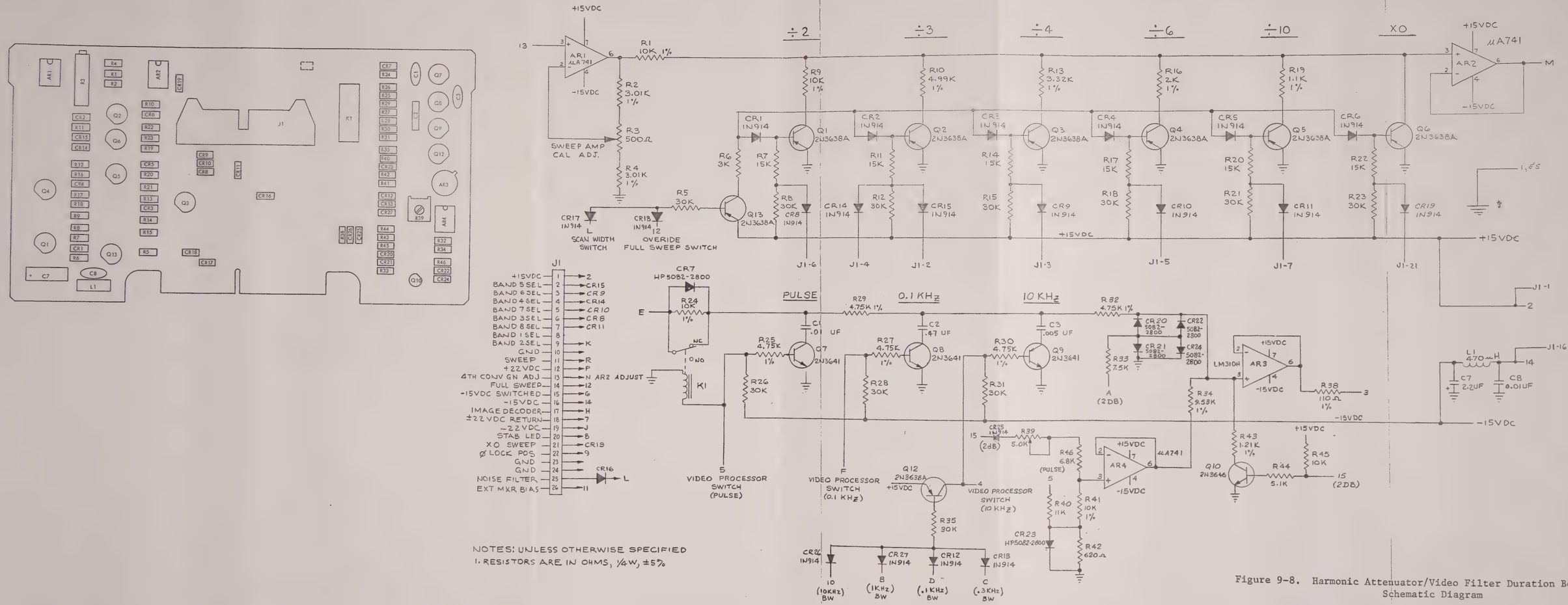
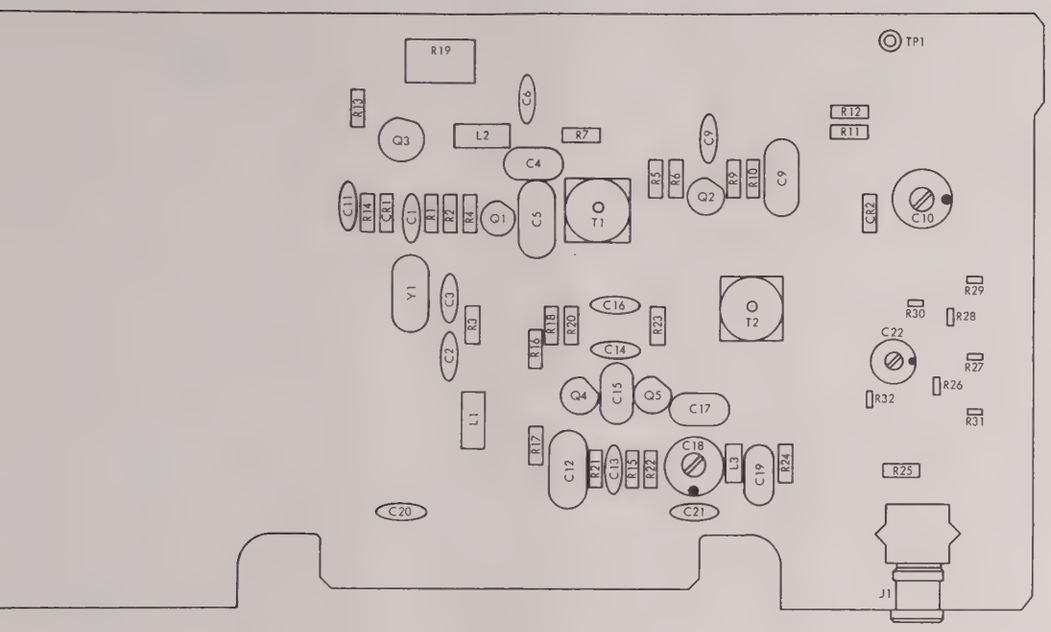
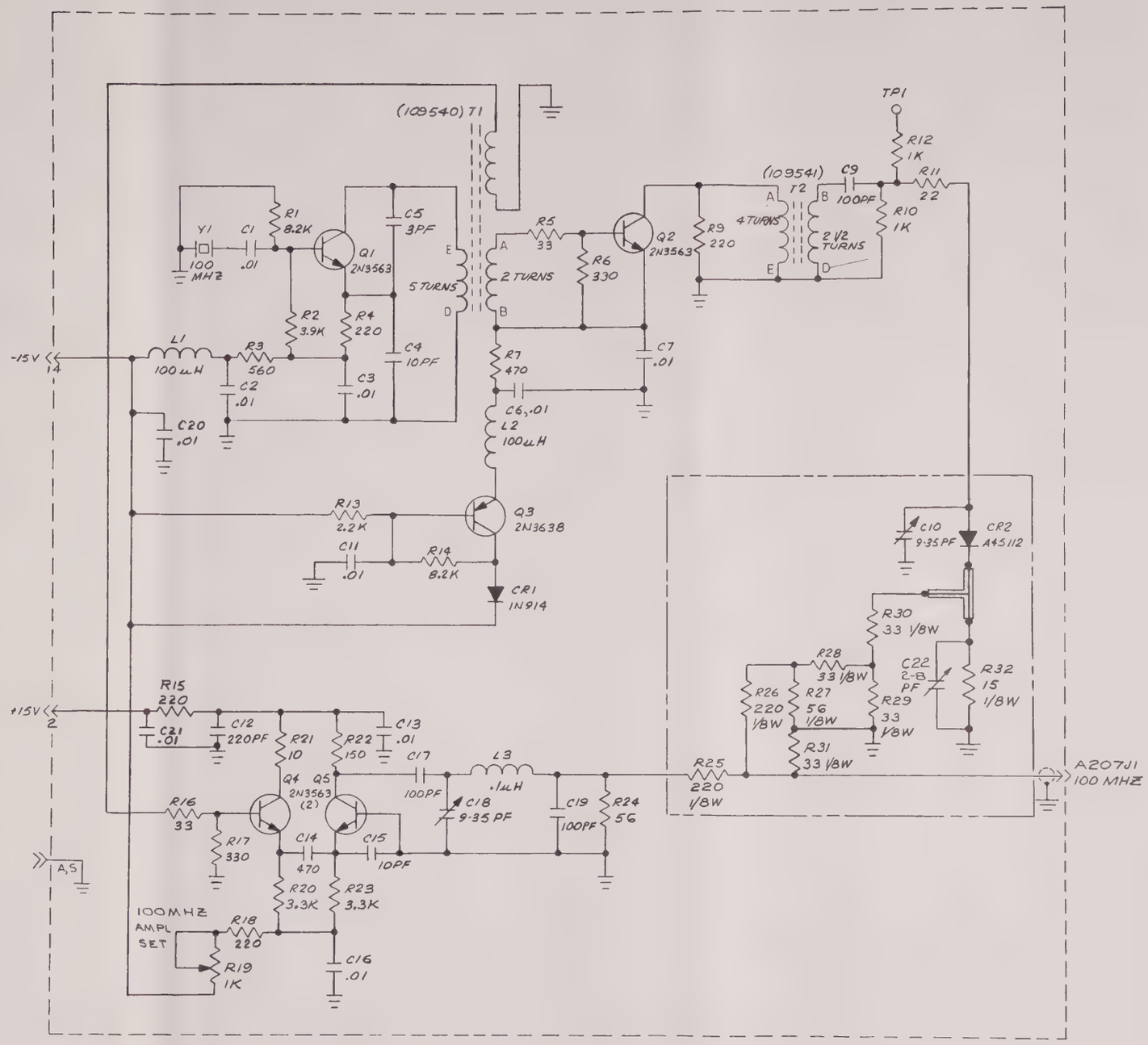


Figure 9-8. Harmonic Attenuator/Video Filter Duration Board A206, Schematic Diagram

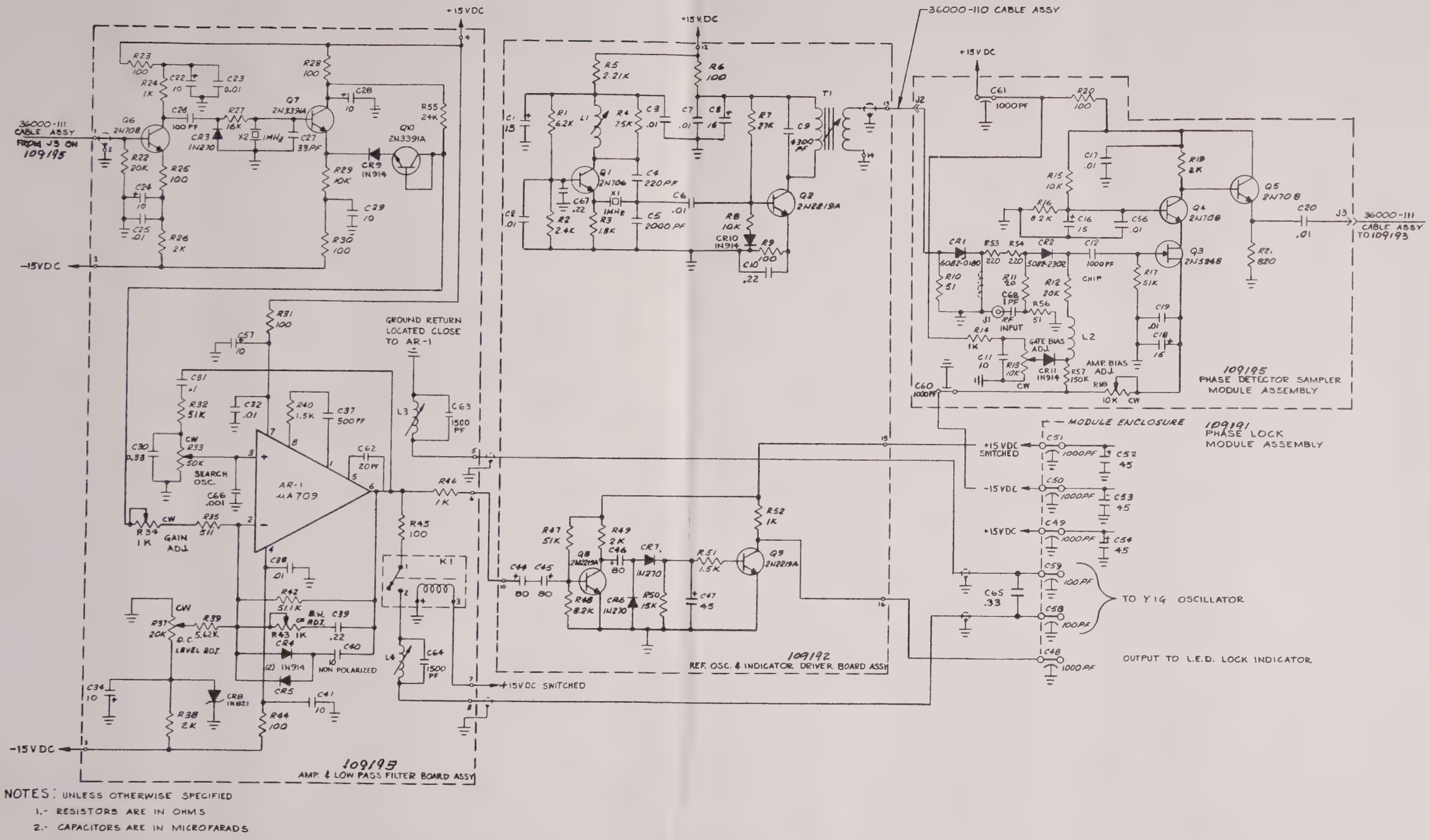




3. ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. ALL CAPACITORS ARE IN MICROFARADS.
1. ALL RESISTORS ARE IN OHMS, 1/4 W

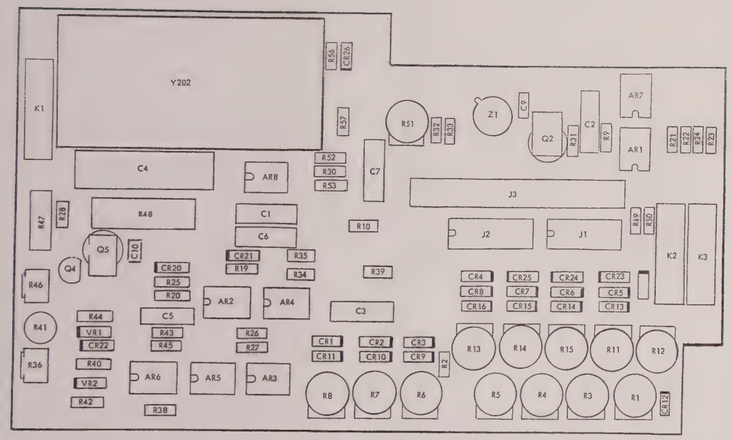
NOTES: UNLESS OTHERWISE SPECIFIED.

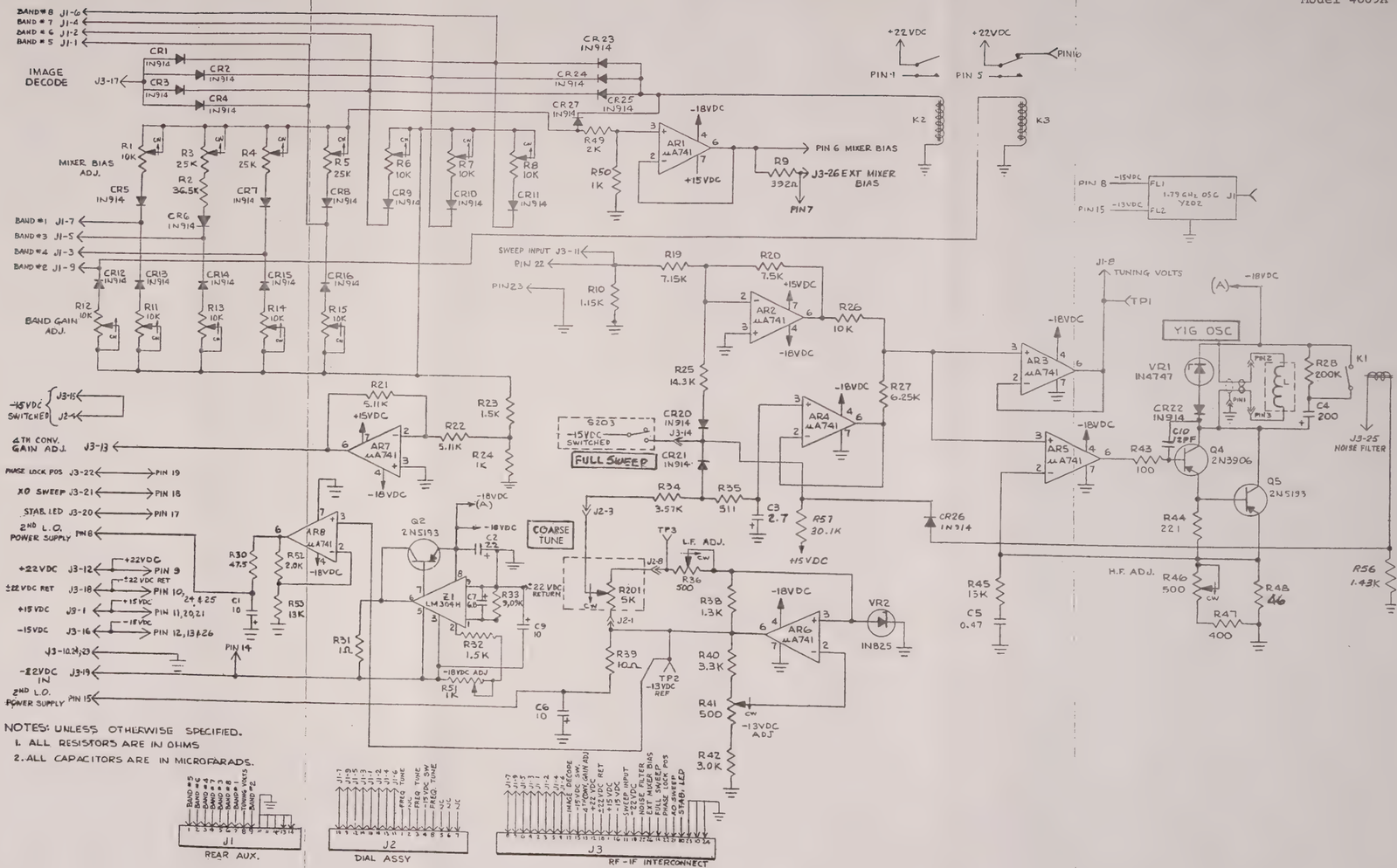
Figure 9-9. 100 MHz Calibrator Board A207, Schematic Diagram



NOTES: UNLESS OTHERWISE SPECIFIED
1.- RESISTORS ARE IN OHMS
2.- CAPACITORS ARE IN MICROFARADS

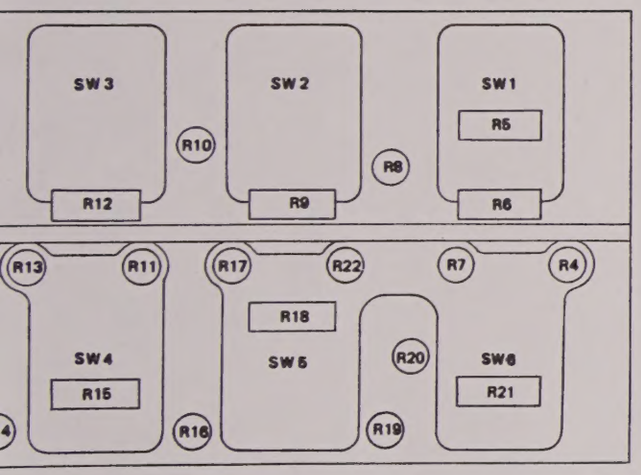
Figure 9-10. Phase Lock Module A209, Schematic Diagram

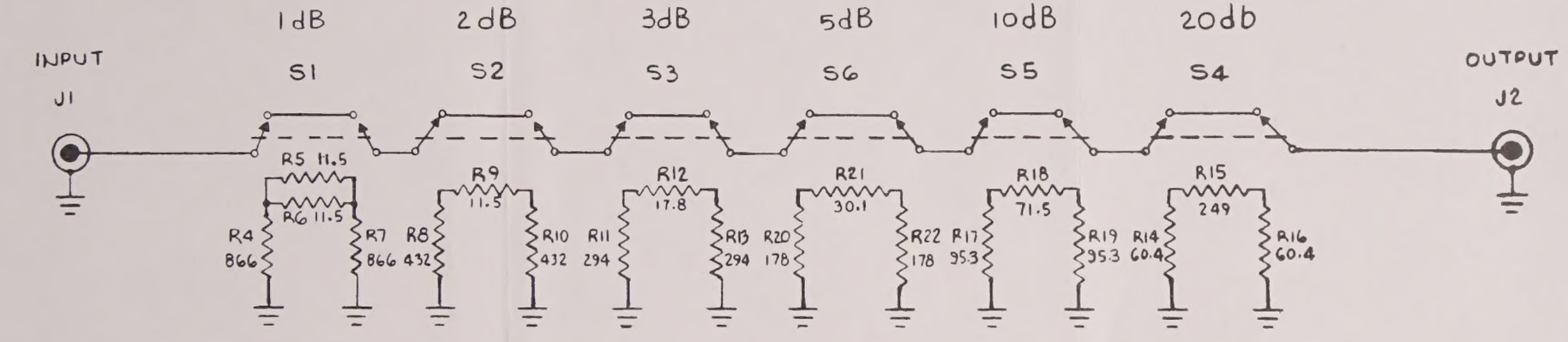




NOTES: UNLESS OTHERWISE SPECIFIED.
1. ALL RESISTORS ARE IN OHMS
2. ALL CAPACITORS ARE IN MICROFARADS.

Figure 9-11. RF Board A211, Schematic Diagram





ALL RESISTORS ARE IN OHMS, 1/8W, ±1%.

Figure 9-12. IF Attenuator AT202

www.manualsplus.com
1024977